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SCIENCE IN THE FACTORY.

IN our last issue we referred, in passing, to the excellent address of Sir Wm. Beardmore to the Iron and Steel Institute; there is so much of value in this address that we have thought it well to reproduce a large portion of it, and have omitted the remainder with regret. The author speaks with knowledge based on an exceptionally wide experience in connection with engineering undertakings of the first magnitude, and we are glad to see that he wholeheartedly advocates the application of scientific method to industrial affairs, giving many striking instances of the improvements and economies which have resulted from its adoption. The fact that immediate benefits may not accrue is clearly brought out in the address; in the case of the great dye industry which the Germans built up on the scientific foundation provided by British genius, no less a period than 17 years was spent in patient and unflagging research before success was achieved, at a cost of a million sterling—but the desired end was eventually attained and immense profits were secured. On the other hand, examples are given of investigations which bore valuable fruit within a comparatively short time of their inauguration.

Another feature of the address to which we would direct attention is his appreciation of the importance of pure scientific investigation, with no apparent bearing upon industrial matters. The researches and discoveries of Faraday, which have given rise to the electrical industry, afford a familiar example of this nature; but others even more striking are adduced by Sir William, such as the discovery—first by pure theory—of Thomson and Joule that a gas expanding through a porous plug was lowered in temperature, upon which is based the liquefaction and separation of gases, now employed on a large scale in various branches of industry, or the recalescence of iron studied by Prof. Barrett, a well-known phenomenon, the investigation of which has led to revolutionary improvements in the manufacture and treatment of steel alloys of the utmost importance to the engineering industries.

There is, however, a jarring note which runs through Sir William's address—the reluctance of the workers to "play the game." He demonstrates, with startling clearness, the fact that *even in war time*, they deliberately restricted their output, and to such an extent that girls, with necessarily very little training, were able to turn out more than double the production of thoroughly trained mechanics working under the same conditions and for the same hours. The gravity of such a statement cannot easily be over-estimated, and the author's conclusion that men capable of such unpatriotic conduct are unworthy of the privileges of citizenship is thoroughly justified. It is not thus that Germany

wages war. We fear that his forebodings as to the future due to the lack of a sense of duty on the part of the worker are only too well-founded. That in pursuing a policy of restriction of output the workman is acting against his own interest is undeniable, and if he could be induced to make a trial of the "square deal" he would soon realise the fact. But the difficulty is to persuade him to try it, and probably past errors on the part of foremen in cutting down piece rates unduly when a man increases his output have a good deal to do with his suspicious attitude towards the employer. It is not only the worker who is selfish.

National Industrial Organisation.

From articles which have been appearing in a number of leading newspapers during the last ten days, we gather that the scheme for combining the several movements which have for their object the formation of a strong national organisation of manufacturers and industries has been advanced a further stage. Circulars are understood to have been issued bearing the signatures of Mr. F. Dudley Docker, C.B., Mr. F. J. Nettlefold (chairman of the Institute of Industry), and Mr. W. P. Rylands (representing the "Central Association"), intimating that as soon as one hundred preliminary members, each guaranteeing an entrance fee of £1,000, have been obtained, the new Association of Manufacturing Interests will be established. Nearly half that number have been secured.

It is safe to assume that the great majority of our numerous large industrial concerns are by now fully convinced of the crying need for such an organisation efficiently to watch over British manufacturing interests, and worthily to represent those interests in the right circles without antagonising Labour. That being so, if these concerns can be convinced, as we think they can, that the combined effort now seeking their co-operation is a serious one, with very substantial backing of influence and funds, they will throw in their lot with those who are eager for the organisation to get to work in time to assist in putting our industrial house in order before Peace is declared. The Association will embrace practically all classes of manufacturing industry—"a sort of industrial Parliament," are the words credited to Mr. Dudley Docker in the Press—but engineering and electrical manufacturing form so extensive and vital a part of the industrial life of the nation that they will inevitably rank very prominently in such an organisation. It is stated that Mr. A. W. Tait, of Basildon House, E.C., is acting as honorary secretary *pro tem.*, and that all correspondence on the subject should be addressed to him.

A Diesel Engine Explosion.

The recent fatal explosion of a compressed-air receiver in connection with a Diesel engine at the Smithfield Markets electric lighting station has been very fully dealt with at the meetings of the Diesel Engine Users' Association, of which reports have appeared in our columns. In some respects the accident was of a similar nature to that which took place at the Bray electricity works in 1912, with most unfortunate results. In both cases, apparently, a mixture of oily vapour with air (enriched with oxygen at Bray) exploded and fractured the containing vessel—the intermediate "purge pot" or receiver in the present instance, the blast bottle at Bray.

While in the latter case the presence of excess of oxygen was probably the main cause of the accident, we pointed out at the time that the insertion of a check valve in the course of the pipe from the blast receiver to the fuel valve would have prevented the explosion. It will be noticed that the makers of the air compressor at Smithfield Markets recommend a similar precaution in the case of the pipe from the compressor to the blast receiver, to prevent the return of air from the receiver to the pump, in the event of faulty operation of the high-pressure valves on the latter.

The dangers arising from the association of compressed air and oil vapour have been well known for many years, and as both these elements are necessarily present in the working of the Diesel engine, in which, moreover, the risk is aggravated by the exceptionally high pressures employed, elaborate precautions to prevent the possibility of accident would be fully justified. All the more, therefore, is it incumbent upon the makers and users of these engines to adopt the simple and inexpensive expedients to which we have referred, and we hope that both parties will by such means endeavour to render the Diesel engine as safe as any other prime mover. The Association, which, though necessarily small, is one of the most active and efficient of our technical societies, may be trusted to throw its influence into the scale of safety and progress.

Lead.

Notwithstanding the prohibition of speculative dealings under the regulations in force, the run of business has been fairy active within the last week or so, at a somewhat lower range of prices, however, due to the fact that the market for early delivery has been chiefly fed by the disposal of controlled lead or metal that was ear-marked or held on behalf of the British Government. Developments, as a matter of fact, have been chiefly the outcome of the operations conducted by Government brokers. The supplies now coming to this country from Australia and Spain are, apparently, largely under Government control; but the fact is worth noting that this control has not resulted in any very material cheapening of the price of the commodity, which, after all, depends chiefly on the law of actual supply and demand. Considering the very liberal quantities of metal which have come on the market of late, the latter has certainly given a good account of itself. The price of prompt delivery dropped to about £33 12s. 6d., thus showing a depreciation of quite £2 15s. a ton from the extreme highest point recorded this year, which has given consumers who were rather short of stock an excellent opportunity of replenishing on more advantageous terms than generally anticipated. A fair number of transactions have just lately taken place in forward positions, whereas business has been for some time past, or since the enforcement of the new regulations, almost entirely confined to near lead. Forward metal is certainly not offering with anything like freedom, which is not surprising, for indications as to future supplies do not point to any excessive surplus.

As shown by the official returns of imports for the past month, the deficit of supplies as compared with the previous year is greater than ever, though this is, to a considerable extent, offset by the fact that the re-exports have fallen off materially this year, which is partly due to the Government restrictions upon export business. For several weeks past, indeed, licences have been very hard to get. So far this month, the arrivals have been again very light, and the surplus for near delivery having been whittled down to moderate proportions, the market now shows greater resistance, although dealers are not disposed to carry much stock, and, in fact, they chiefly confine their purchases to actual demand from consumers. The chief sustaining factor in the situation continues to be the big outlet for munitions, while the demand for ordinary industrial purposes is considerably under the normal, which is explained by the marked slackness of the building trades. Rollers, however, are being kept fairly busy by the large Government orders for war purposes.

The fact may be mentioned that operations on the part of white and red lead manufacturers are seriously hampered by the ever-growing scarcity of labour, while a keen demand has been experienced for this material for some time past. The bulk of the English output of white lead is, apparently, absorbed or reserved for Government purposes, and those consumers who placed orders in America find considerable difficulty in securing shipments through lack of freight, while American terms have been raised considerably. The position of pig lead in America is not quite so tight as it was a few weeks ago, the demand having fallen off somewhat, both for domestic and export, and prices have eased off appreciably, but they still stand at a relatively high level, which practically prohibits the resumption of shipping business with this side. The French takings from Spain direct continue on a large scale.

The Working of "Unsealed Patents."

A new range of patents—"the unsealed patents"—is now thrown open to applicants for licences. An application of considerable moment, the first under new legislation of this year, was made to the Controller of Patents, Mr. Temple Franks, and the Deputy-Controller, Sir Cornelius Dalton, on Thursday last week. The Patents Court was set up by special legislation to deal, under the Patents, Designs and Trade Marks (Temporary Rules) Acts, 1914, with the patents of alien enemies. Hundreds of German patents, a good many electrical, have been applied for by British manufacturers, who desired to manufacture under a Board of Trade licence for the supply of the British and Colonial trade. The novel application heard last week was made under new legislation passed only a few weeks ago—the Trading with the Enemy Amendment Act, 1916. This relates not to letters patent already granted, but to an important department of the newest examples of inventive skill—the applications which have been received from the Continent since the outbreak of the war, or immediately before it, for British patent rights for new devices, for which as yet no sealed patent has been issued. Specifications have been required to be filed, but the authorities in this country have done nothing in the direction of conferring rights and transforming the applications into sealed patents. These "unsealed patents," as they are called, are now thrown open for the investigation and application of British manufacturers and users. The first application under this new legislation is, therefore, a significant event, not to be overlooked by those who are consulting the needs of the public and of British industry in these times.

The first application for an "unsealed patent" had to do with the German Timmer machine for grinding blades, and was made by two Sheffield firms in order to fulfil War Office contracts of so extensive a kind that they could not ordinarily comply with them.

The machine, curiously enough, comes from the German Sheffield—Solingen. The Controller made clear the procedure in this new class of case. The Public Trustee will probably be made custodian of the "unsealed patents," and while the licence has been issued by the Board of Trade hitherto, the new type of licence will be executed by the Public Trustee and granted in his own name, though it will be prepared by the Solicitor of the Board of Trade. The Public Trustee will hold the royalties, and it will be necessary (the Controller pointed out) for somebody to pay the sealing fee, for the unsealed patents must be sealed to someone before they can be used.

It is stated that there are some two thousand of these "unsealed patents" filed, together with their specifications. The first application, the Controller announced, would be granted.

CENTRAL ARGENTINE ELECTRIFICATION.

An important railway electrification scheme, which is approaching completion, is that comprising the Central Argentine Co.'s suburban line from the new Retiro Station (Buenos Aires) to Tigre (*viâ* Victoria), which has a route length of 28 km. From a description of this scheme which appeared recently in the *Central Argentine Railway Magazine*, it appears that Messrs. Merz & McLellan reported favourably on this project in 1910, and that the scheme, having received the approval of the Argentine Government, steps were subsequently taken to carry it into effect, with the result that it is practically completed. Electrical energy will be generated in the company's power house at Canal San Fernando, and transmitted through 20,000-volt underground cables to sub-stations at the Canal San Fernando, Victoria, Olivos, Palermo and Retiro. The sub-stations at Canal San Fernando, Olivos and Palermo will convert to direct current at 800 volts, at which pressure the current will be supplied to the third rail. The sub-station at Victoria is a static sub-station, and will supply three-phase current at 440 volts for power and lighting requirements at the Victoria workshops and station. Retiro sub-station will convert to 220-volt direct current for the supply of light and power to the new Retiro station and goods yards.

Electrical energy will be supplied to the trains by means of a third rail, and will return to the traction sub-stations by means of the track rails. The rolling stock is arranged on the unit system, and each unit will consist of one motor coach coupled to one trailer coach. A train can thus consist of one to six units, that is, two to twelve coaches.

With the exception of Tigre C. and Victoria the electric lighting at the local stations on the electrified system will be supplied direct from the third rail. At Victoria, the Victoria sub-station will supply the current, while at Tigre C. motor-generators will reduce the current at 800 volts from the third rail to a pressure of 200 volts, at which pressure the lighting will be carried out.

The power house is situated on railway property midway between the Canal San Fernando station and the River Luján. The foundations are in the form of an armoured concrete raft supported on about 3,000 piles driven to a depth of 10 metres.

The power house, with its machinery, is now completed. The building is of steel framework, with walls of reinforced cement plaster, and is divided into two main parts, the engine house and boiler house. There is a bay along each side of the engine house; in one the high-tension switchgear is housed, and in the other, which is adjacent to the boiler house, all the water tanks and feed pumps are situated. The engine house is spanned by an electrically-driven travelling crane.

The boiler house has three main floors: a basement, or ash-handling floor, a boiler house floor, and an economiser floor. The boilers and economisers are arranged on each side of the boiler house, and above them are coal-bunkers which have a capacity of 1,000 tons. Alongside the boiler house in the open is a coal store for 6,000 tons of coal.

In the engine room are installed four 3,300 kw. turbo-alternators of the Parsons type. The alternators generate at 2,500 volts, 25 cycles, and run at 1,500 r.p.m.; they are direct coupled to step-up transformers, which raise the voltage to 20,000. Below each turbine is situated its surface condenser and auxiliary machinery.

The circulating water is obtained from the River Luján by means of four electrically-driven circulating pumps which pump the water from the river to the condensers.

The high-tension switchgear is installed in concrete cells reaching from the basement to the roof of the switch house.

There are six boilers of the multitubular type fitted with mechanical stokers, superheaters, induced and forced draught. Each boiler has its economiser placed directly above it, the waste gases from each pair of boilers being dealt with by the one chimney. The ashes and soot are handled by means of the vacuum ejector system.

Coal, as a rule, is brought from Campana, or Villa Constitucion in wagons, and lifted by an electrically-driven jib

crane, with grab attachment, into the open coal store, or into receiving hoppers. Two coal-crushers reduce the coal to a small size; a bucket elevator conveys it to the top of the boiler house, where it is transferred to a tray conveyor running over the overhead bunkers. It is expected that about 50 tons of coal will be burned per day.

Practically all the cables have been laid and jointed, and are ready for use. The H.T. cables are all of the three-core, paper-insulated, lead-covered and wire-armoured type, and are in duplicate. In general, the cables have been laid in the ground at the boundary lines on each side of the track. Each H.T. feeder has laid alongside it a pilot cable for the automatic protective gear for cutting out faulty feeders.

Telephonic communication has been arranged for by means of underground telephone cables, which link up the various points of the electrified system.

The three traction sub-stations are practically identical, and have been completed. The buildings are of the same type as the power-house building. Each sub-station contains three rotary converters, each of 1,000-KW. capacity. The direct-current feeders are paper-insulated, bitumen-sheathed, and are laid in fibre conduits filled with bitumen.

Work has just been commenced on the foundations of the Retiro sub-station. Besides the machinery required to convert the H.T. current, there will be installed a large battery to ensure a continuous supply at Retiro station, in case of repairs to, or breakdown of, the power-house plant or distribution cables. It is expected that this sub station will be ready for use before the end of the year. Victoria sub-station will be completed in a month's time.

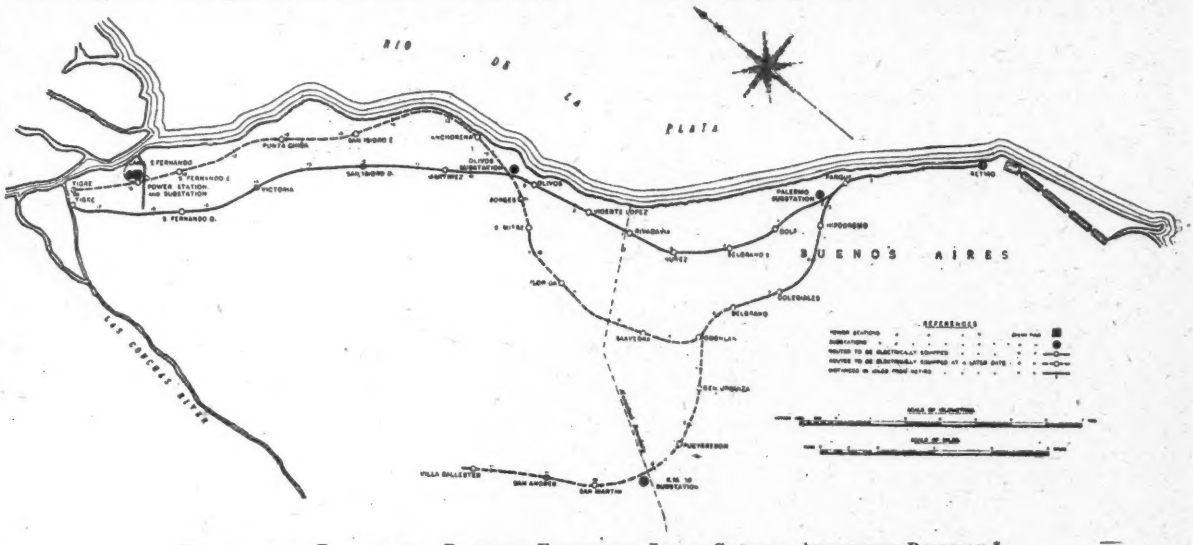
Most of the third rail has been laid. It is in the form of a channel with the open side of the channel towards the track. The shoes on the train make contact with the underside of the top flange of the third rail. The whole third-rail system is divided into sections controlled by switches and circuit-breakers housed in the traction sub-stations and several of the signal cabins. The third rail will be protected throughout by means of creosoted boards attached to the top and side.

In all, 117 electric coaches have been ordered. Of these 50 are trailer coaches, 55 are motor coaches fitted with two motors per coach, and 12 are motor coaches fitted with four motors per coach. The four-motor coaches will be used principally for express trains and special trains on race meeting and regatta days.

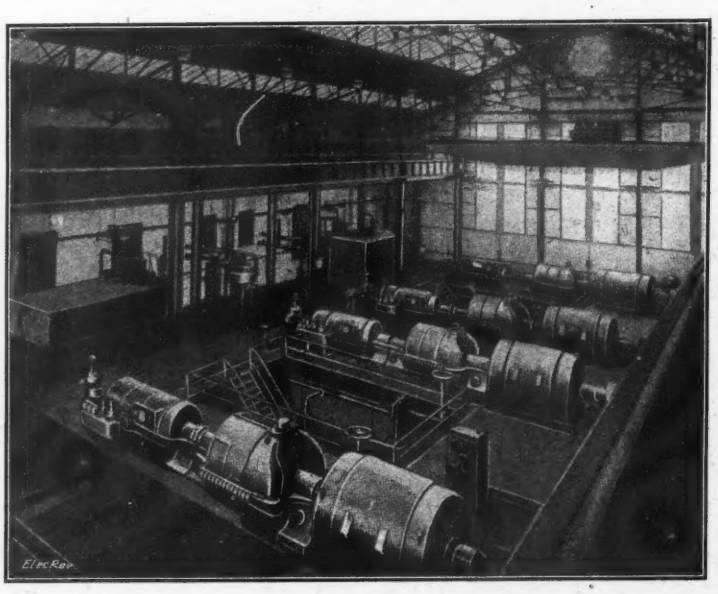
Owing to the war, only 30 trailers and 42 two-motor coaches have been received. The balance is not expected until some time after the war has ceased. The trailer coaches were received about two years ago, and lately the electric equipment has been fitted to these coaches. The 42 two-motor coaches are practically ready for service. The coaches are equipped with 250-H.P. motors and control gear.

It is expected that with this stock the express trains from Tigre to Retiro will make the journey in about 30 minutes, making two stops on the way, while the electric trains stopping at all stations will be able to make the journey in approximately 45 minutes. Repairs to the rolling stock will be carried out at Victoria workshops, at which large alterations and additions to the buildings and machinery are being made for the carrying out of this work.

The tracks between the Canal San Fernando Station and the Tigre (R.) Station have been equipped with the third rail, so that electric trains can be run there for the purpose of giving motormen a thorough course of instruction and training before the electric service is commenced. Since the middle of September an electric train composed of two motor and two trailer coaches has been running daily for the purpose of showing up any faults there might be in the electrical equipments. So far, this train has run 3,600 km., and not a single fault has developed.



PLAN SHOWING PRESENT AND PROPOSED ELECTRICAL LINES, CENTRAL ARGENTINE RAILWAY.*



TURBINE PLANT AT THE CANAL SAN FERNANDO POWER HOUSE.

* Map reproduced from *Proceedings*, West of Scotland Iron and Steel Institute.

ACCOUNTING FOR POWER FACTOR IN THREE-PHASE SUPPLY TARIFFS.

THREE-PHASE generation and distribution being undoubtedly the standard system of the future in all industrial districts, and industrial loads being frequently of low power factor, any proposals for taking power factor into account in charging for A.C. supply are of quite special interest. That the wattless current demanded by a load of poor power factor does involve considerable idle investment in generators and cables is well known, and no doubt readers are acquainted with the investigations and proposals of Prof. Arno in this connection. Broadly, these proposals are that costs due to low power factor be covered by charging each consumer for his true consumption plus a fraction of the difference between his real and apparent consumption, this fraction varying with circumstances from 25 to 50 per cent. Taking 33 per cent. as an average value for this fraction, the power for which the consumer has to pay (in a case where the real power is E I cos ϕ and the apparent power E I), is $\frac{2}{3}$ E I cos ϕ + $\frac{1}{3}$ E I. The method proposed by Arno for measuring this complex quantity was displacing the driving pressure-coil field backwards with regard to the driving current-coil field by an angle greater than 90°, and varying (according to the range of power factor for which the meter is designed), between 100 and 150° or so.

On non-inductive load the reading of such a meter is identical with that of an ordinary watt-hour meter, but on inductive load the special instrument reads higher. The units in which it records are, however, "complex" units, so that even if the law of the country does not preclude the use of an Arno meter as the sole basis of charging, there is no indication for the benefit of the supply engineer and the consumer concerning the actual power consumption and power factor. It is obviously desirable that the supply engineer should know the actual power and power factor, otherwise he cannot judge properly the development of his undertaking, and remodel tariffs from time to time. The consumer is more than likely to chafe at the mystery of the "complex unit" on which he is charged, and there is certain to be trouble if, due to lower power factor, his bill comes to more than in a preceding period, for which his ordinary working records show that the true power consumption must have been greater. The consumer has every right to demand that, if he is to be charged on power factor as well as true power, his meter should give him such information as will enable him to check, and possibly improve, both these quantities. Finally, there is the serious objection that an Arno meter reading, say $\frac{2}{3}$ E I cos ϕ + $\frac{1}{3}$ E I will not give correct readings with any other fractional coefficients, though it is obviously quite likely that, due to extensions or other changes in the supply station and network, the fraction of wattless current charged for should vary from time to time. Similarly, if a consumer's installation gave at first a power factor between unity and 0·8, but subsequently was extended by the addition of a number of motors, so that the power factor then varied between 0·85 and 0·6 it would be necessary to substitute a differently adjusted meter. These difficulties, though not insuperable in a laboratory or special installation, become of the gravest importance under commercial conditions where continually varying loads are concerned.

It is not necessary, however, to use the special Arno meter (which is inferior in electrical and mechanical characteristics, to most modern watt-hour meters), in order to work on Arno's principle of charging for real power plus a proportion of the wattless demand. R. Stoppler, in a recent copy of the *Elek. Zeitschrift*, points out that separate measurement of the two products E I cos ϕ and E I sin ϕ provides all the essential information and requires only the use of meters of standard construction, whilst overcoming all the objections cited above. If the load current lags on the supply pressure E (fig. 1), a meter reading E I cos ϕ would record the watt component E i_1; and a meter reading E I sin ϕ would record the wattless component E i_2.

Connections for such meters are given later. Assuming for the moment that their readings are available, they may be used for a complete analysis of the load conditions by aid of fig. 3. In this chart values of ϕ and cos ϕ are plotted against values of tan ϕ as as abscissæ (tan ϕ = E I sin ϕ/E I cos ϕ = reading of sine meter/reading of cosine meter = wattless component/watt component).

ELECTRICAL TRAIN, CENTRAL ARGENTINE RAILWAY (see p. 556).

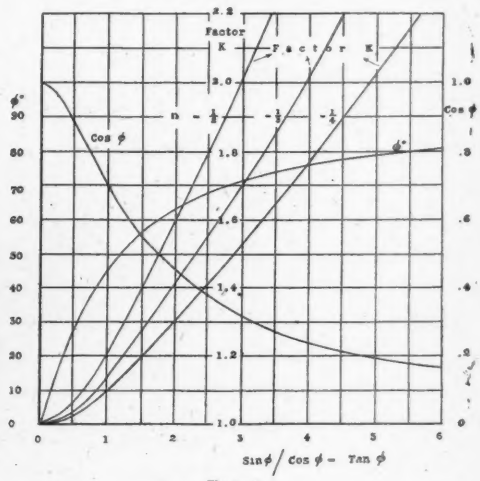


FIG. 3.

The meanings of the factors n and k introduced on this chart are as follows:—Arno's basis of charging is [real power + n (apparent — real power)] where n is a fraction. This reduces to (E I cos ϕ + n (E I − E I cos ϕ) = (1 − n . E I cos ϕ + n . E I), which may be expressed as k × E I cos ϕ, where k is the factor by which the real power reading must be multiplied to give the value of Arno's complex power. It will be seen, therefore, that from the readings of meters recording E I cos ϕ (*i.e.*, true power) and E I sin ϕ respectively, there can be deduced the power factor and the correct total for charging on Arno's system for any value of n and for any load power factor. To eliminate calculation of tan ϕ, a chart can be prepared on the principle shown in fig. 2, setting E I cos ϕ along the axis of ordinates, and E I sin ϕ along the axis of abscissæ, the length A B representing the apparent power E I to scale and the angle O A B = ϕ.

In applying this system of metering it is simply necessary to add to the existing meter which records real power (E I cos ϕ), a similar meter so connected as to record E I sin ϕ. In the case of a balanced three-phase load an ordinary A.C. motor meter may be connected as in fig. 4, the current coil in one phase, and the pressure winding across the two other phases. The driving fields are then in phase and the meter registers proportionally to E I sin ϕ. In the vector diagram to the left of fig. 4, the flux F_2 lags 90° on the E.M.F. E_2 which produces it, and is in phase with i_1 so long as the load is non-inductive.

A better arrangement for recording the wattless component E I sin ϕ correctly in any three-phase system, at all power factors and states of load balance, is indicated in fig. 5, and really amounts to duplicating the arrangement in fig. 4. The flux F_2 is made to lag 60° on E, and hence to lead 30° on i_1; and the flux F_1 is made to lag 120° on F_1 and hence to lag 30° on i_3. When thus arranged the meter yields high torque, has small internal loss and is easily calibrated.

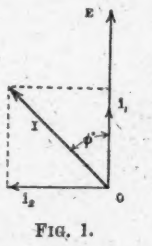


FIG. 1.

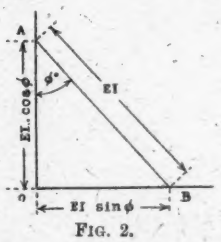


FIG. 2.

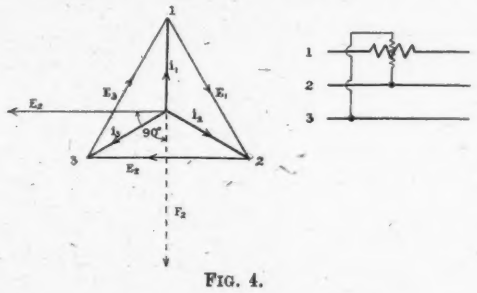


FIG. 4.

For a three-phase, four-wire circuit, three measuring systems are required, connected as in fig. 6 with the pressure windings in star, and each connected to another phase than the one containing the current coil with which it works. The fields of the pressure coils being made to lag 60° on the E.M.F.'s producing them, they

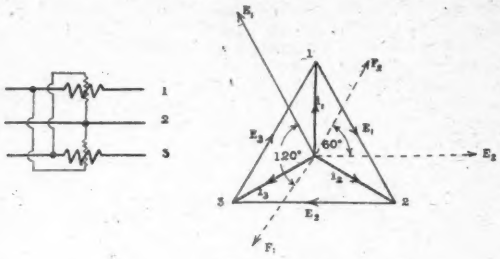


FIG. 5.

come in phase with the main current fields when the main load is non-inductive and the torque produced is proportional to the wattless power of the outers against the neutrals. Other arrangements are possible in the above and other cases, but enough has

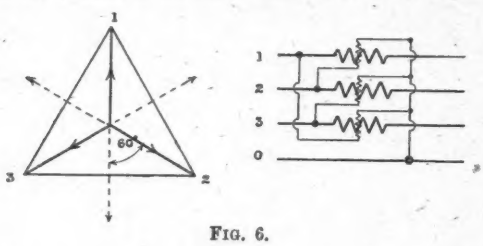


FIG. 6.

been said to illustrate a convenient means of applying the admittedly sound principles enunciated by Arno, without incurring the practical difficulties involved by using meters designed to record automatically a composite quantity which includes an arbitrary and gradually changing numerical factor.

A RAILLESS TROLLEY-BATTERY VEHICLE.

THE new motor-wagon designed by Mr. C. J. Spencer, general manager of the Bradford City Tramways, for the conveyance of goods in connection with the ordinary passenger tramway service, which was referred to in our "Notes," was given a trial recently, and the *Yorkshire Observer* says it was found to work with smoothness and efficiency in every respect. The new vehicle is quite simple in design, but wonderfully adaptive to the purposes to which it is to be put. Taking the chassis of an old railless trolley-car, Mr. Spencer has built upon it a long, broad lorry, similar in shape and dimensions to the motor-lorries which have become so familiar in recent times. The great difference is, that instead of using petrol, which is so dear in these days, the new transport wagon is run by means of the existing electric tramway equipment. It may thus have the advantage of greatly reducing the demand for the precious petrol, minimising running costs, and at the same time contributing greatly to the public convenience at a time when there is so serious a deficiency in transport services.

The adaptability of the new wagon was demonstrated to the chairman of the Bradford Tramways Committee (Mr. Enoch Priestley) and several other interested persons, at a test of the vehicle on the 8th inst.; at the Thornbury tramway depôt it was seen manœuvring with the facility practically of an ordinary motor-car. A load of two tons was put on the wagon, and with this it made a satisfactory journey to Wibsey. The great advantage of the new wagon is that it can travel either by means of the electric equipment of the tramway system or independently of it, by means of a battery carried on the vehicle.

The equipment of the chassis of the railless trolley-battery vehicle is similar to that of the ordinary railless trolley-chassis, with the addition of the battery, and includes two 20-H.P. motors with ordinary series-parallel control, and it will therefore operate on a 500-volt circuit. The earthing device is an extension of the steering arm of the vehicle, bearing on the track by the medium of a cast-iron block, and at the same time automatically steering the vehicle. (This device, which has been used with considerable success for some time in connection with the Bradford railless trolley-cars when taking them over the tramway routes to the depôt, was designed by Mr. E. Cross, the general manager of the Rotherham Tramways.)

The accumulators employed are 120 cells of the Edison type, giving a normal voltage of 150.

These supply current to the ordinary 500 volt motors, the only difference being that the motor with battery supply runs correspondingly slower, that is, *pro rata* to the voltage, but as the torque of a series motor is proportional to the current passing through the windings, the vehicle is capable of climbing steep gradients, but at a speed corresponding to the low voltage.

Whilst the vehicle is running on the 500-volt circuit the battery may be in series with the motors, thus charging it whilst the car is in trolley service. The battery is capable of running the vehicle about 10 miles.

The change-over from battery to overhead wire is merely a question of throwing over a switch, the putting of the trolley on the wire and the earth connector on to the steering gear.

We are indebted to Mr. C. J. Spencer for these details and for our view of the vehicle.

DIESEL ENGINE USERS' ASSOCIATION.

AT the May meeting of the Association reference was made to the fact that the list of membership was now representative of upwards of 30,000 B.H.P. of Diesel engine plant. Several further engineers having control of such plant were elected members.

Discussion on the Smithfield Market explosion was resumed.

MR. R. L. QUERTIER, the London manager of Messrs. Ravell and Co., Ltd., who attended the meeting by invitation, made some remarks on behalf of his firm, who were the makers of the air compressor concerned. While not wishing to be dogmatic, he said, they had a theory which seemed to fit the case, and which, if correct, showed that quite a simple precaution should prevent further accidents of a like nature. The abnormal conditions shown by the examination of the compressor after the accident were, so far as they knew, confined to the high-pressure suction and delivery valves, which were exceedingly badly carbonised, and to the relief valve on the intermediate purge-pot, which, when tested after repair, only blew off freely at about 380 lb. per sq. in. This relief valve was set by the makers to blow off at about 275 lb. per sq. in., so that it must have been re-adjusted by screwing up the spring to the limit.

The accident occurred almost immediately on starting up after the engine had been out of service for some hours, and therefore the temperature of the compressor was very much lower than normal, and it would seem that the conditions were not at all favourable for an explosion to take place. There seemed no doubt, however, that an explosion did occur, as, in the first place, a calculation of the strength of the purge-pot showed that the bursting pressure would be in the neighbourhood of 2,500 lb. per sq. in.; and, secondly, the fact that it was broken into fragments indicated a heavy and instantaneous shock, and not the fracture at the weakest section, which one would expect with a steadily-increasing load, even if that were rapidly applied.

RAILLESS TROLLEY-BATTERY VEHICLE FOR GOODS SERVICE ON TRAMWAYS.

Assuming, therefore, that an explosion occurred, and that this was caused by the ignition of lubricating oil, it had been suggested that such explosions were caused by the ignition of oil in the form of mist or fog. One, therefore, had to account for the oil fog and for the means by which the temperature was raised to ignition point. His firm's theory was as follows:—

The high-pressure valves were not functioning, with the result that there was, more or less, open passage connection between the final delivery-pipe to the blast-bottle and the intermediate purge pot. The valve between the blast-bottle and the compressor was opened just before the accident, and this would allow the dense air in the blast bottle to rush back along the pipes to the intermediate purge pot by way of the high-pressure cylinder. They suggested that the velocity at which the rush took place and the density of air caused it to lick up and carry away any oil deposited on the pipes and to churn this into a fog. The intermediate relief valve, as tests recently made proved, was capable of dealing with all the air aspired by the compressor with a rise in pressure of not more than 30 lb. per sq. in., but it was obviously incapable of dealing with an almost instantaneous rush of air from the blast bottle, and consequently the pressure rose till a balance was attained. All the while, of course, the intermediate cylinder was delivering air, and had now to compress against this greatly increased pressure, so that the temperature of the delivered air rapidly increased till it was sufficient to ignite the oil mist in the purge pot and cooling pipes. It was not necessary for this rush back of air to take place immediately the blast bottle valve was opened, because the compressor was at work and the conditions necessary, namely, a more or less free passage into the I.P. purge pot and coils, might not have been immediately present. Again, the same conditions would be obtained with a slower leak back if for any reason the I.P. relief valve were not in proper working order.

If this theory were the correct explanation of the explosion, it was clear that the greatest safeguard possible would be a back-pressure valve inserted in the final delivery pipe between the blast bottle valve and the compressor. Mr. Quertier thought that this valve should be fitted close to the blast-bottle end of the pipe, as there the air pulsation would be less definite and the air would be cooler. These conditions would ensure the valve working freely without undue wear or tendency to stick.

Quite apart from the accidents above referred to, he thought it was clear that no undue rise in temperature could occur in the compressor, even if either or both the high-pressure valves failed, if in the first place the air in the blast bottle were prevented from rushing back by the above-mentioned check valve, and, secondly, if the intermediate-pressure relief valve were kept in proper working condition, so that it would prevent the I.P. delivery pressure rising, by blowing off all the air aspired by the compressor with the reasonable rise in pressure for which the relief valve was designed.

The next meeting of the Association will be held on Friday, June 23rd, when Mr. Geo. E. Windeler will read a paper on the subject of "Methods of Lubrication and the Difficulties of Efficiently Lubricating a Diesel Engine."

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Special X-ray Reflectors for Half-Watt Lamps.

To permit advantage to be taken of the well-known merits of the X-ray lighting system, when using half-watt lamps for the direct lighting of shop windows or other interiors, the BRITISH THOMSON-HOUSTON CO., of Mazda House, 77, Upper Thames Street, E.C., have developed three new reflectors for use with Mazda half-watt lamps. These reflectors embody the same merits as the ordinary X-ray reflector in respect of scientific design, freedom from striation, and permanently high reflecting efficiency. The distinctive feature of the new patterns is the provision of a special backing to withstand the high temperature of half-watt lamps, which would destroy the silver backing of the ordinary X-ray reflector.

The "Jove" X-ray reflector, which is very similar in appearance to the "Scoop" type, is intended for use with 100-watt Mazda half-watt lamps, and is suitable for windows of average proportions. It throws an equal amount of light back and down, which distribution is suitable for windows from one to one and a-half times as high as they are deep. If the window height be about twice as great as its depth (measured from the front glass to the background), the "Jupiter" X-ray reflector, in conjuction with a 100-watt Mazda half-watt lamp, throws a powerful beam of light downwards, and thus meets the needs of the case. In general appearance, the "Jupiter" reflector much resembles the "Helmet" pattern of ordinary X-ray reflector.

The "Jumbo" reflector, for use with 500, 750 or 1,000-watt half-watt lamps, is altogether a unique production. It is the largest one-piece glass reflector ever blown (16½ in. diameter, 13⅜ in. high), and is particularly suitable for the efficient direct illumination of very large interiors. This reflector requires a special metal hanger, at the top of which a special holder can be supplied with an adjustable feature, which makes it possible to obtain two or three degrees of spread to the light.

The makers confidently anticipate that the "Jumbo," "Jupiter" and "Jove" super-X-ray reflectors will continue for half-watt lighting the sterling services already rendered by X-ray reflectors in the development of good lighting.

"Jove" type for low windows.

"Jupiter" type for high windows.

FIGS. 1 & 2.—X-RAY SILVERED GLASS REFLECTORS FOR MAZDA HALF-WATT LAMPS FOR WINDOW LIGHTING.

Westinghouse Flour Mill Plant.

A description of a flour mill installation, in which the electrical equipment was supplied by the BRITISH WESTINGHOUSE CO., of Trafford Park, Manchester, appeared in a recent issue of the *B. W. Gazette*, from which the following notes are abstracted.

The original engine-drive included a good deal of gearing which it was desired to supersede. The main mill consisted of four floors, each with a line of shafting, while a wing of the building contained the cleaning and conditioning plant. The question of the electrical sub-division of the drive was considered, and it was decided to install a 110-H.P. motor to drive each of the four main lines of shafting, while the drives for the cleaning, conditioning and auxiliary plant were determined by the circumstances in each case.

The mill contains a 35 40 (280 lb.) sack plant, and is fitted throughout with three-phase slip-ring motors.

Owing to the lack of space, the motors for the main mill were let into the lines of shafting, and coupled up by flexible couplings, as shown in fig. 3; in order to use high-speed motors, the shafting speed was increased from 175 to 375 R.P.M., and, as changes in pulleys were necessary, it was decided to increase the break-roll speed by 15 per cent., and that of the reduction-rolls by 25 per cent., the result of which has been quite satisfactory.

In order to ensure that the four motors shall be started simultaneously, the starters for the rotor circuits, shown in fig. 4, are geared together, and operated by one handle; the starters are also interlocked with stator circuit-breakers on the wall behind, so that the latter cannot be closed unless the former are in the off

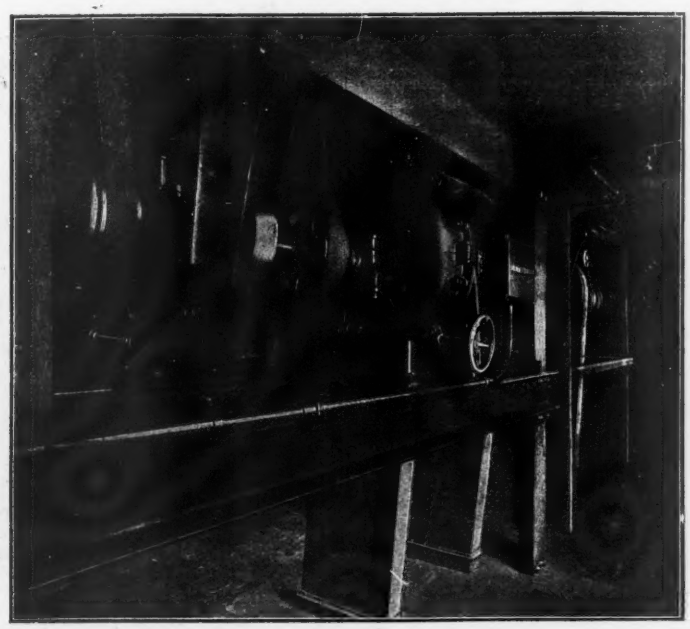


FIG. 3.—WESTINGHOUSE SLIP-RING PIPE-VENTILATED MOTOR DRIVING LINE SHAFT

position. The circuit-breakers, which are oil immersed, are fitted with time-element overload and no-volt releases, and, in addition, emergency push-buttons in various parts of the mill can operate the latter releases.

The speeds of the scalpers, centrifugals, &c., were not altered.

The wheat-washing and conditioning plant has a separate motor drive, as also the wheat-cleaning plant.

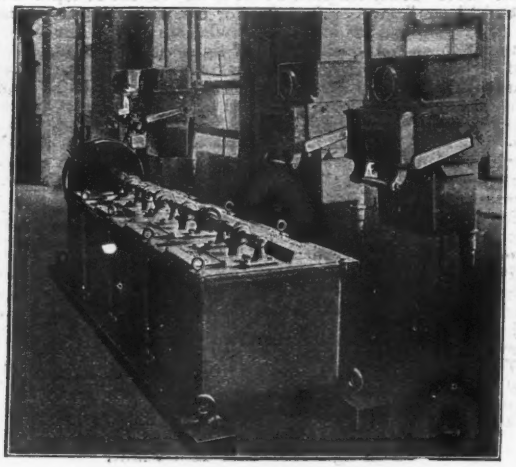


FIG. 4.—COUPLED WESTINGHOUSE LIQUID STARTERS.

Separate motors are also installed for driving the grain intake plants, sack hoists and general warehouse plant. In practice, it is found safe to speed up sack hoists 25 per cent.

The current is derived from a supply company's transformer, and passes through a distribution board. The work was carried out by the British Westinghouse Co., under the supervision of Messrs. Horace Boot & Partners, consulting engineers.

Large Direct-Current Switchboard.

During the last few years the GENERAL ELECTRIC CO., LTD., of 67, Queen Victoria Street, E.C., has produced a considerable number of heavy-current switchboards for various municipalities, and a recent example of this class of board is shown in fig. 5. This board consists of 23 panels, comprising generator panels for controlling the continuous-current side of two 1,620-KW. motor-generators, with Witton-Kapp phase-advancers, which are being manufactured by the G.E.C. at Witton. It also includes a large

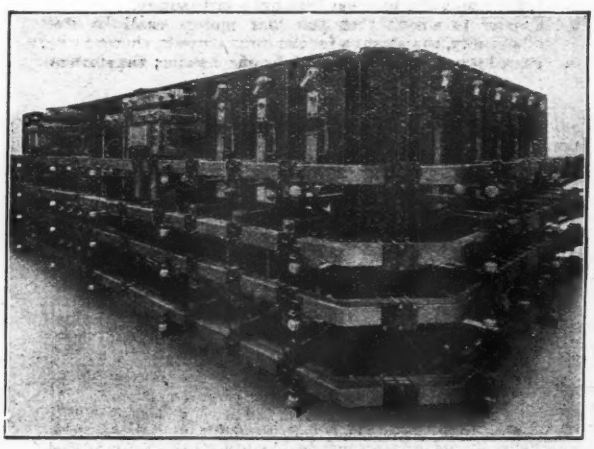


FIG. 5.—VIEW OF BACK OF HEAVY-CURRENT "WITTON" SWITCHBOARD, SHOWING ONE OF THE SIDE PORTIONS.

number of feeder panels for distributing the energy. The board has been constructed in a form occupying three sides of a rectangle; the panels have a thickness of 2½ in., being composed of oiled slate slabs; in addition, all the circuit-breakers are mounted upon their own slabs, 2½ in. thick. The circuit-breakers controlling the generators have a capacity of 10,000 amperes. Some idea of the heavy character of the gear can be gained from the size of the bus-bars, the latter being composed of 24 strips of copper, each 4 in. × ½ in. thick.

The Employment Department.—The Board of Trade announces that the Labour Exchanges and Unemployment Insurance Department will in future be known as the Employment Department of the Board of Trade.

THE APPLICATION OF SCIENCE IN FACTORIES.

BY SIR WILLIAM BEARDMORE, BART.

(*Extracts from a Presidential Address to the* IRON AND STEEL INSTITUTE.)

THE war, with its revelation of great influences at work, has taught us all lessons which must be assimilated and acted upon to the fullest extent. These lessons are ethical, political, and industrial. They are interdependent; each affects the other; and it is difficult to discuss one without involving the other. But, obviously, in this Institute we are more concerned with the industrial and economic factors of the problems. Even with this limitation, the subject offers wide scope for consideration. The industrial lessons involve science and technics, design and manufacture, volume and economy of production, and, finally, the relation of both employer and employé to all of these. All are correlated, and we can only achieve our aim if everyone, from the least skilled of workers to the greatest of industrialists, resolves to consider the bearing of each not only upon himself, but upon the prosperity of the Empire.

Science comes first. It is the dominant factor, because it should be the beginning of all things, and yet it is only one element in the problem, because there must be co-operation between laboratory research and manufacturing development. This should be strongly enforced, as there is a tendency at the moment to neglect the other factors. There is a great need for the extension of research and experiment, and my experience is that much of this work is highly remunerative, either positively in improved processes of manufacture, or negatively in eliminating faults and obviating wastage. Much of it, however, is unremunerative, and in any case all of it requires money. Excessive competition in manufactures narrows profits, and leaves little money for such work. Manufacturing firms have therefore difficulty in finding the wherewithal to embark initially on scientific research work, or they are compelled, after starting it, to limit expenditure on its continuance. The refusal of workers to utilise to the best advantage improved methods of manufacture, evolved by experimental research, discourages industrialists in their evolution and application. These are axioms whose truth could be established by many examples. When a charge of lack of enterprise is made against manufacturers, blame should at the same time be laid at the door of workers who do not realise that their interests are intimately affected by the attitude they display in all such cases. There lies the political connection with the problem. It is not enough for the State to assist or otherwise encourage scientific research and experiment. The nation is equally concerned with the profitable application of the results, in order that national prosperity shall be augmented by ensuring that the fullest utility will be derived from scientific research and experiment. The question, therefore, is a national one. The employment of the people and their well-being depends upon plenty of work. This, in turn, requires the maintenance of a great export trade. Efficiency and economy in manufactures can do much to win and retain foreign as well as British Imperial markets. This necessitates advance towards perfection of design and greater volume of output, through improvement in the mechanical means of production evolved by experiment. It follows that research should be a charge on the selling price. To counterbalance this charge it is essential that the volume of output should be increased. Thus, when we reach the bedrock of industrial conditions we find that, unless restrictions and limitations dictated by workers' organisations are abolished, much of the gain possible to the nation due to research and experiment must be lost.

An example may here be given of the influence of the restrictive methods of Trade Unions. Early in the war it was found at the Parkhead Forge that the output from the respective machines was not so great as what the machines were designed for, and one of the workers was induced to do his best to obtain the most out of a machine. He very greatly increased his output, notwithstanding his predilection for trade union restrictions. When it was found that the demands of the Government for a greatly accelerated production of shells required the employment of girls in the projectile factory owing to the scarcity of skilled workers, these girls in all cases produced more than double that by thoroughly trained mechanics—members of the trade unions—working sentative cases may be quoted thus: In the turning of the shell body the actual output by girls with the same machines and working under exactly the same conditions and for an equal number of hours was quite double that by trained mechanics. In the boring of shells the output was also quite double, and in the curving, waving and finishing of shell bases quite 120 per cent. more than that of experienced mechanics. These conditions applied to war time, when the peril of the nation demanded unselfish, patriotic exertion by everyone, and the men who thus limited the output can only be regarded as unworthy of the privileges of citizenship. In peace time the same results, due to restrictive measures, must necessarily handicap severely all manufacturers in their aim to advance the prosperity of the nation by ensuring adequate employment for all.

There is little need to demonstrate that ideal conditions in manufacture are associated with a higher rate of wage and large total earnings per worker per week, and this is attainable without forfeiture of a satisfactory profit, provided—and this is the crux of the whole problem—all workers make the most of all the appliances which scientific research and mechanical experiment may place in their hands, by increasing the volume of production per unit of time and by working full time. These, again, are well-known economic laws, but they are not enforced often enough. Until they are applied, the gain from the application of science to industry will not be fully realised for the benefit of the workers of the nation.

The awakening of the worker to such responsibility is thus as important as the arousing of the nation to the need for more scientific methods. But that does not in any way excuse the manufacturer for any deficiency in enterprise. In fairness, however, it should be made clear that some progress has been made in this direction in our own history. A few iron and steel manufacturers as long ago as the eighties began tentatively to carry on chemical and metallurgical research work, and they have been steadily and continuously increasing the extent of the work done, with very satisfactory results. The present crisis and the prospect of a great trade war in the near future justify a consideration of the importance of increased diligence in this essential department of industrial activity and of the encouragement afforded by results in the past.

Scientific research falls naturally into two main divisions, and in considering how such work can be extended it is important at once to differentiate between the two. The work may be characterised in the one case as purely theoretical, almost classical; in the other as distinctly technical or practical. In the one, the results are indicative of potentialities for the future, more or less remote; in the other they are for immediate application, or generally contemporaneous with actual manufacture. Obviously only a limited amount of what I have termed classical research can be undertaken by the manufacturer, particularly where the current demands for chemical, metallurgical, or mechanical research for practical work monopolise much time and apparatus. Such classical work must, therefore, be separately undertaken. Where it is not dependent upon experience in every-day industrial work, it would seem that State or other public laboratories could readily undertake it. This condition would apply to new processes, to new discoveries, or to new materials. This line of demarcation of scientific work is further justified, because in public laboratories the difficulty of practical direction or control is often experienced. Where there is an attempt to do work capable of immediate application, it becomes essential that the guiding influence should be immediately conversant with every-day practice in the factory. In this category there are, therefore, included improvements, whether in chemical or mechanical processes, in combinations of metals, or in the reduction of the cost of production. All of these are more or less dependent on precedent, and consequently require complete intimacy with existing conditions.

There should be no disposition to limit the original or purely classical work in scientific research. When this is borne in mind only good can accrue from close association, even in such purely scientific research, between the industrial and the theoretical scientist. What is distinctly theoretical to-day may become the practice of to-morrow, and no one who has been associated with such work can fail to realise that there are no more difficult questions presented for decision than the potentialities, from a commercial point of view, of problems solvable in the laboratory.

Purely theoretical research may yield important commercial results, and we are thus brought into contact with one of the difficult problems associated with national expenditure on such work. It is admitted that science knows no boundaries; but at the same time there is the important commercial rule that national expenditure must be justified by national gain. Where humanitarian work is involved no one will object to the gain from national expenditure being universal. Thus, all work for the prevention of accidents in mines, or in other employments, may be undertaken by the State, and the publication of results broadcast be justified. But where a new discovery, a new process, or new materials of great advantage to the industry of a nation are evolved, the advantage ought to accrue to that nation. It is admitted that between the discovery of the germ of a great idea and its application to manufactures much diligent work must be done, and that, too, of an important scientific character. But with the disclosure of the basic idea the subsequent work becomes inviting, perhaps comparatively easy, even if it is expensive or requires long and expert experiment. With the conduct of research in public laboratories a difficulty arises in connection with the publication of scientific results.

There should, however, be a great extension of the practice of conducting experiments on behalf of firms who direct and pay for such research, particularly of firms who desire to follow a definite line of research not immediately connected with any of their manufacturing processes, and whose current work does not permit of such researches being undertaken. No doubt in the future there will be much of this work for such public institutions, and a satisfactory measure of secrecy will be attained. There would no longer be the objection that the fullest experience of current works practice is not available by those engaged in the public laboratory if there were such direct and close contact between the public laboratory and the works of the firm directing and paying for the research.

One of the difficulties in finding a scientific staff for the factory is the limitations of our educational system. It has been put on record recently that at Cambridge only four colleges are presided over by men of scientific training; at Oxford not one; and that of the 35 largest and best-known public schools 34 have classical men as headmasters, and in no case do scientists hold a high place. It may be contended that such institutions were intended originally to give a classical or liberal education; that they were based on the concept that the fundamental principle of education is the cultivation of the mental faculty. On the other hand, science has become so essential, not only to the industrial, but even to the domestic life of the nation, that scientific training might be made to serve a greater part in the future than in the past in cultivating the mental faculty. In any case, the accepted principle that entrance to the largest number of posts in the Civil Service should be contingent on an examination where science plays the smallest, if not a negligible, part, tends to encourage the youth of the country to neglect scientific training, and to bring into the service of State departments, many of which are concerned with scientific work, men with little knowledge of and less sympathy with science. The State endowment of research has been delayed, and is now hampered, by the absence of this influence in Government staffs. Until there is an educated and liberal-minded control of our industrial and commercial Government departments, the true relation of the State to science can never be realised nor its benefits fully materialised. It is because of the gradual awakening of publicists to these considerations that many look with the greatest measure of hope to a quickening of interest in scientific research within factories. No firm which neglects such work can expect to achieve the highest success, industrially or financially. We must still pursue a vigorous policy of enlightening the working classes on the importance of the fullest advantage being taken of all chemical and mechanical improvements conducive to increased production. But, at the same time, no opportunity should be neglected of enforcing the need for a more active participation in research and experiment by manufacturers in all processes of production.

I am persuaded, from my own experience, that reward follows from the pursuit of scientific methods. Continuous investigation by a trained staff is absolutely necessary for efficient work, and it is essential that managers and works superintendents should be sufficiently acquainted with the scientific side of their work to apply in a practical way the recommendations made from the laboratory and ensure the desired results. This presupposes co-ordination between the manufacturing staff and the research staff, so that we have here, again, a proof that scientific work must be done in the works, under the stimulus of the chief. For this reason, too, it is desirable that young men should have at least the first part of their practical laboratory training within the works. Educational authorities should maintain a closer contact with the works, so that not only would these young men be grounded in school laboratories for practical work, but the student would have a better chance of being placed subsequently in a position in the works laboratories where his ability would more readily be developed. And here I cannot refrain from the suggestion that the training in works laboratories should be regarded as part of the higher education of the future metallurgist, and that there should not be an immediate desire for high remuneration. Experience is of far greater permanent value than the earning of a big wage at the commencement of a scientific career.

While we should be masters in one branch of science we should know a little of all others, and watch all progress sympathetically and intelligently.

In 1889 Sir Robert Hadfield dealt before this Institute with alloys of silicon and iron, and his investigations, taken up by others, led to the important discovery that certain elements, like silicon and aluminium, could render steel more permeable under low magnetic fields than the purest commercial iron then available. The usefulness of this discovery to the electrical engineering trade was at once recognised, and a special silicon steel was shortly afterwards applied to the manufacture of transformers. From this purely scientific work there has sprung the trade in special transformer sheets, &c., and it has been computed that in the nine years from the introduction of this material the aggregate output in America alone of machines using it amounted to no less than 14,000,000 KW., and the annual saving in the latter year in electrical energy, due to its better magnetic properties, was about 10,000,000 dollars.

A further illustration of the value of organised research applied to the improvement of an industrial product is afforded by that undertaken to find the factors which prevented the present metallic-filament lamp from being run at a higher efficiency than one watt per candle-power. By adopting the results arrived at, a lamp was made which had an efficiency of 0.5 watt per candle-power and an average life of 2,000 hours—the now well-known "half-watt lamp." This, it is safe to predict, will ultimately supersede all other forms of glow lamp, and be a serious rival even to the flame arc itself.

Scientific methods applied in the works can achieve much in avoiding wastage, in ensuring greater reliability in processes, in providing labour-economising mechanical appliances, and by recovering all by-products. Every industrial process should be examined constantly and methodically by

the trained scientific staff, whose sole duty it would be to elucidate the principles upon which the process depends, and to ascertain, in the laboratory first, and afterwards in the works, the conditions of maximum efficiency. Every failure and every flaw should be recorded and explained, so that the cause may be avoided and the process of manufacture improved. Responsibility, therefore, rests upon all manufacturers to make such research work part of their productive methods.

A great duty and responsibility rests also upon the State and upon the worker. Instead of being hampered by legislation manufacturers should be encouraged, because on manufactures the prosperity of the nation will depend much more in the immediate future than in the past. What is required is that everyone, scientist, technologist, employer, and worker shall do his best for the common weal. It would be easy to demonstrate that many developments towards improvement and increase in production, in a great variety of factories, have been regarded as mediums only for justifying the same wage earnings for the same output with less physical effort. Were the highest efficiency of all such improvements realised by the workers, their earnings would be higher and the output would be greater without any increase in physical effort. Charges would be spread over the greater volume of output, manufacturers would be encouraged to prosecute research work to a still greater extent, and by the improving of the character of the production and the cheapening of its price the nation would be better equipped to face the keen competition in all the markets of the world which is bound to arise in the immediate future. There would be no unemployment problem. Thus, while we foster metallurgical science, we must not neglect the equally important subject of industrial economics and the duty of the State and the worker towards such problems.

WAR ITEMS.

The German in British Commerce.—At the annual conference of the Association of Trade Protection Associations of the United Kingdom, held last week in London, in bringing forward a resolution on behalf of the London Wholesale Hardware Club, which recommended the affiliated societies to ask their members to print names of partners or directors on their stationery, and against these names to put the country of the partner's or director's birth, Mr. Nettlefold (according to the *Ironmonger*) thought that a main object of every trade society and Chamber of Commerce ought to be to get rid of the Germans who had come over to do business here. "Most business men left at home were now unfitted for shouldering the rifle, but they might well take the knife and try to get rid of the cancer which had been undermining the country's strength. There were two classes of Germans involved: one was the unnaturalised, which was being dealt with by the Board of Trade, which, like all Government departments, moved slowly. If the war went on another ten years they might perhaps dispose of 20 per cent. of this class. The Association should suggest that an Advisory Committee of every trade in the country should be brought together to help the Board of Trade in this matter in their own special individual trades. If, however, they were going to get rid of the naturalised Germans in trade, it must be done by showing there was a feeling of repugnance against them."

Exemption Applications.—At the Saltburn Tribunal an application for extension made by an electrical engineer was refused.

At Stockton-on-Tees, Ald. T. B. Watson applied for exemptions in the case of John Thomas Walton, aged 39, the manager of the electrical fitting and plumbing business of T. B. Watson & Son, at Middlesbrough, and of his son, Coun. H. C. Watson, aged 36, who is in charge of the plumbing and electrical department at Stockton. Exemption for three months was granted in the case of the manager at Middlesbrough, and the application in regard to Coun. Watson was adjourned.

At Stalybridge, last week, Mr. F. Schofield, commercial manager of the Joint Tramways & Electricity Board, appealed for the exemption of Samuel Holt, aged 25, traffic clerk. The three other clerks formerly employed in the office are now on military service, and it was urged that special training was required for the position of traffic clerk. Conditional exemption was granted.

At the Exeter Tribunal, an electrician who applied for a wireman said it was true that women were being trained in this calling in the city, but they would not be able to do the work for at least six months, if they could then, which was very doubtful.

At the West Sussex Appeal Tribunal, a Worthing Kinema appealed for the exemption of a single man, aged 27, an electrician, wireman, and spare-part maker. His was claimed to be a certified occupation. The Local Tribunal had refused exemption as the occupation was not certified. Capt. Dawes said that this was the very class of man who was wanted for the Army. A wireman was no longer an exempted occupation, and recruits of the class were wanted for the Royal Engineers. The appeal was dismissed.

At the Southwark Tribunal, Messrs. Alexander Hawkins and Sons, electrical engineers, applied for the exemption of the manager of their dispatch department, who was responsible for the repair of electric motors in works where Government contracts were being carried out. He was granted exemption as being in certified occupations, the stipulation being that he should join the Volunteer Training Corps for Home Defence, if required. Mr. F. J. Hawkins, a member of the firm, was also granted a similar exemption. He was a fully-trained electrical fitter, and was superintending the erection of motors in munition works. The firm had lost 13 men since the outbreak of the war.

At a sitting of the Newcastle Local Tribunal on 9th inst., Mr. E. Hatton, manager of the Corporation Tramways, appeared in support of the application for the exemption of certain tramway employés from military service. He said they had a number of married men conductors who were being trained as drivers. Out of 823 employés, there were 133 who were eligible for service. There were 30 single motormen he must keep, and there were 100 married men who had received conditional exemption. There were 107 conductors who were being trained as drivers, and these he desired to be exempted. In reply to the Chairman, Mr. Hatton said if the Government would release soldiers who were no longer needed for service, he would be glad to release some of the Corporation employés, but the Government would not hear of it. There was, too, an increasing difficulty in getting hold of women. The Chairman suggested that an application be made to the Ministry of Munitions to secure released men so that further tramway employés might be released. It was agreed that the motor-men should be given conditional exemption, and a similar course was adopted with respect to 32 single drivers, who were being trained as drivers, and 75 married conductors. It was also decided that all up to and including Group 7 (men under 25) should be refused exemption, all inspectors up to and including Group 40, and all labourers at the power station also should be refused exemption.

Total exemption has been granted to Mr. Ernest Bond (31), applied for by the Wedmore Light & Power Co., Ltd. It was stated that Mr. Bond was the only one left to supervise the gas plant, engines, dynamos, batteries, and other apparatus, and to do the necessary repairs.

Before the Herts. Appeal Court, a Luton electrical engineer appealed against a period of exemption granted by the Local Tribunal. He said that he was induced to start business through being misled at the recruiting office, where he was told that he would not be required by the Military. The appeal was refused.

At Colchester, the manager of an electrical engineering business at Marks Tey, owned by a lady, was granted three months' exemption. The employer stated that appellant was the only one left in her employ, and if he went the business would be closed, and she would be without means.

The Southend-on-Sea Tribunal has exempted until June 1st an electrical engineer, who has been in business for nine years at Westcliff. He said that he had contracts to complete, and that he employed two assistants who were under military age.

A Buxton electrical engineer appealed to the Local Tribunal for himself and one of his men. He stated that all his capital was invested in the business, and military service would mean financial ruin. He was engaged on military hospital work, which would take some months to complete. Five of his staff had enlisted, and he had failed to find a successor for the man appealed for. The employer was given six months, and the employé two months.

The Heckmondwike Tribunal has granted conditional exemption to an electrician engaged by a local firm.

Conditional exemption has been granted to the resident electrical engineer at the Keswick generating station. It was stated that he was the only electrician available, and that if he went the works would have to be closed.

At Coventry, Messrs. Hutt Bros., electrical engineers and contractors, appealed for Mr. A. Franklin, electrical engineer, the only eligible man left. Mr. Hutt stated that he was running the business single-handed, and was himself called up. The matter was put back for 14 days with a view to badges being secured for Mr. Hutt and his employé. Mr. Frank D. Chambers, electrical contractor, who also appealed, was exempted until May 31st.

At Buxton, application was made for exemption for the engineer-in-charge of the electric light plant at a local hydro, who, it was asserted, could not be replaced. The Tribunal allowed exemption until October 5th.

At Dover, on May 10th, the manager of the Burlington Hotel, appealed for the hotel electrical engineer (30). The Advisory Committee recommended no exemption, and this was agreed to.

The Amersham Tribunal has refused extended exemption to Hugh R. Butler (24), electrician to Mr. Freeman, of Chartridge, who stated that he was engaged upon important experimental work, and that Mr. Butler was essential, as he maintained the plant.

An electrician, 32 years of age, married, applied to Clayton-le-Moors Tribunal, on May 12th, for exemption on business grounds. He had contracts to complete, and he could not

get anyone to take his business. He was the only electrician in Clayton-le-Moors. Exemption granted to July 10th.

At the Tynemouth Tribunal application was made on behalf of an electrician, aged 27, employed by a local firm. The head of the firm stated that the young man was the only qualified electrician left in the town (North Shields), the others having either gone into "controlled" establishments or joined the Colours. Conditional exemption was granted.

At Oldham, an electrical engineer and contractor who had lost four men, appealed on his own behalf, and was exempted till September. He also appealed for his brother-in-law, aged 19, who was employed by him as an electrician and wireman. He urged that he was absolutely indispensable, but the appeal was disallowed, the man, however, not to be called up before June 1st. Temporary exemption for two months was sought by another Oldham electrician for an employé in order that existing contracts might be completed. This appeal was disallowed, but the man is not to be called up before July 1st.

At Warrington, an electrical engineer and contractor appealed for exemption, and it was stated that seven of his employés had joined the Army. He was responsible for the maintenance of the electrical plants at some of the local munition works. Application had been made for badges for himself and some of his employés, and on hearing this the Tribunal adjourned the case for a month.

Johannesburg and Trade After the War.—In our last issue we reprinted from a South African contemporary a series of recommendations respecting after-the-war trade which had been before the Johannesburg Chamber of Commerce. This report, it is interesting to state, was adopted at a general meeting of members called at the suggestion of the B.E.A.M.A. South African Overseas Committee, and held on April 3rd. All the B.E.A.M.A. Overseas Committees are working towards the same end, namely, the protection and maintenance of the British electrical export industry, and in connection with these efforts they are enlisting the co-operation of engineering and commercial associations in their respective territories in bringing their objects before the various Dominion Governments.

To be Wound Up.—The following appear in the latest list of enemy businesses to be wound up by order of the Board of Trade:—

Bleichert's Aerial Transporters, Ltd., 36, New Broad Street, E.C., constructors of aerial wire railways. Controller: Mr. W. Hancock, 90-91, Queen Street, E.C.

The Flender Co., Broad Street House, E.C., wooden pulley manufacturers. Controller: Mr. J. Baker, Eldon Street House, E.C.

Hammer, Bayreuther & Co., 21, Mincing Lane, E.C., rubber merchants. Controller: Mr. R. J. Knight, 3, Raymond Buildings, Gray's Inn, W.C.

Prohibited Exports.—A number of pages of the "Board of Trade Journal" for May 11th are occupied with a lengthy list (revised and complete) of prohibited exports.

The list will also be found in the "London Gazette" for May 12th.

Germany's Investments Abroad.—A Reuter dispatch from Christiania states that the German firm Schuckert, of Nuernberg, which owned half the shares in the Hafslund Joint Stock Co., has recently sold its shares to a Norwegian firm. It is understood that the purchase price was 18,000,000 kroner (about £1,000,000).

INDIAN NOTES.

[From Our Special Correspondent.]

The present week, April 21st, ends the longest period which India has been without a full mail since the war began; the last mail received being dated March 17th, and the next mail in will be April 22nd. The mail of home date, March 25th, was apparently on the ill-fated *Sussex*, and only a very few bags reached India. Electrical firms are inconvenienced as much as most others, as one looks out for home mails these days with extraordinary anxiety, for our invoices of goods long ordered and still not advised.

A stroke of extraordinary luck overtook a particular well-known firm recently. With big lamp orders booked, and not a word of advice of their shipment from home, a message was unexpectedly received from the harbour authorities that a consignment of 10,000 lamps was lying in the goods sheds awaiting delivery with demurrage daily mounting up! Delivery of the lamps was soon taken.

Metal-filament lamps are about the only electrical goods which have not advanced in price in India since the war began. In fact, if anything, the prices have decreased somewhat. The principal lamps marketed are the Osram, Mazda, Ediswan, Phillips, and Wotan.

An attempt was made some time ago to regulate prices, and meetings were held, attended by representatives of the different lamp interests, but nothing practical was done; in fact, worse price-cutting than ever took place afterwards. This is somewhat of a pity, because electrical business in plant and other electrical material is slack and is bound to continue so, and consequently a legitimate profit on lamps would be welcome.

The Calcutta Supply Co. has recently offered a reduction in its rates from July 1st, to five annas for lighting units and three annas for fan and small-power units or, if preferable, a flat rate of four annas all round, with substantial rebates after the first 5,000 units. Although this seems a substantial reduction, it only affects the large consumer to any extent. A flat rate has been asked for by the public for some time as it simplifies installations, lessens meter rents to half, and incidentally reduces the first cost of wiring by about 20 per cent. This, in itself, is something, but the small consumer still cries out for more reduction.

LEGAL.

Röntgen Ray Electric Apparatus.

In the Patents Court, on Wednesday last week, Messrs. Watson and Sons (Electro-Medical), Ltd., applied to avoid or suspend Letters Patent Nos. 9,499, of 1912, and 13,903, of 1913, registered in the name of the Siemens & Halske Aktien-Gesellschaft, Berlin, in order themselves to manufacture in this country an electrical appliance for use in connection with Röntgen-ray radiographs.

The applicants' case was presented by Mr. E. C. R. Marks, and Mr. Imray appeared for the patentees, the patents being nominally registered as owned by the German company, though they were said to be beneficially owned by Messrs. Siemens Bros. and Co., Ltd., of Woolwich.

The patents cover improvements on the ordinary form of electric apparatus, in order to obtain a more satisfactory discharge in the X-ray tube. The invention aims at reducing the time constant of the apparatus, by varying the primary circuit at the moment of commutation. Immediately prior to commutation the whole of the primary winding is in circuit. The commutator automatically cuts out half the primary, so that at the moment of commutation only half the primary coil is in circuit. The same result may be obtained by having two primary windings with different time factors. Before the commutation, the patentees have the primary of higher time constant in the circuit, and at the moment of commutation they automatically cut in a second primary having a lower time constant.

A statutory declaration was read by Mr. Geoffrey Pearce, managing director of Watson & Sons (Electro-Medical), Ltd., who explained that the applicant firm were a sub-company of a very old-established British company, Messrs. W. Watson & Sons, Ltd., of 313, High Holborn, London, and were on the contractors' list of the Admiralty, the War Office, the India Office, and many foreign Governments, and were engaged in the manufacture of X-ray and electro-medical apparatus.

The company possessed every facility for the manufacture at their own works by their own British workpeople of apparatus constructed in accordance with the specifications, and they desired to manufacture the apparatus to fulfil an urgent Government order which they had obtained. They had also other orders and inquiries for the apparatus, and it was highly desirable at the present time that this apparatus should be manufactured to an adequate extent in this country, to meet the growing demand.

Mr. Imray pointed out that Messrs. Siemens Bros. & Co., Ltd., were beneficially interested in the patents, were doing a great amount of Government work, and were prepared to carry out the manufacture of this type of apparatus. However, as the Government had approached Messrs. Watson & Sons (Electro-Medical), Ltd., Messrs. Siemens Bros. & Co., Ltd., would not object to a licence being granted to them. The only question that remained was the question of royalty.

Mr. Marks offered 2½ and 3 per cent. on the patented part of the apparatus, roughly half of the entire apparatus, which would cost about £100. Finally, the applicants agreed to pay 4 per cent. on the selling price of the entire machine.

The Controller of Patents (Mr. Temple Franks) intimated that he favoured the issue of a licence to the applicants, and stated that they would hear from the Board of Trade on the subject in due course.

Adams v. Broadbent.

With reference to our report of this case, Mr. Frank Broadbent writes as follows:—

"One or two little inaccuracies have crept into your report of the above case, but there is only one which I desire to correct, namely, the statement that the counsel for the plaintiff expressed the opinion that my later patents were not valid. This is not the case: the plaintiff's witness admitted in cross-examination that if my patents were valid his company had infringed them, but he expressed no view at all as to the validity."

Munitions Cases.

At the Oldham Munitions Tribunal, last week, a Trade Union secretary appeared on behalf of two men who desired leaving certificates from their employers—an electrical firm. When the case was called, the representative of the firm said he thought he could save time by making a short statement. The two men, he said, were in a reserved occupation, being engaged on certain work in the meter department. The firm had communicated with the

military authorities, and it had been agreed that they should release as many of their hands as possible. They had stuck to that, and the firm could now release these two men who were applying for leaving certificates, as they would be able to replace them with female labour. He proposed, therefore, to inform the military authorities that his firm no longer desired to keep these men in the reserved occupation, and he took it that they would enter the Army. The Trade Union secretary was commencing to address the Tribunal about something that was said by the firm's representative at a sitting of the Tribunal some months ago, when the Chairman (Mr. James Hodgson) interrupted, and said that had nothing to do with the matter. The applications of the men were granted. The Trade Union secretary said he should take the matter up elsewhere, and would instruct the men to register as munition workers. The Chairman said he was afraid he could not hear the secretary any further. The firm's representative had undertaken to grant the leaving certificates, and there was nothing before the Court.

At the same Court, a man appealed for a certificate enabling him to leave the electrical works where he was engaged, and return to his former employment as a coal miner. The firm's representative said they left it to the Court to decide whether the man was rendering greater national service where he was than if he were in the pit. The appeal was refused, the Chairman stating that the man had made out no case for a certificate.

PETITION FOR PROLONGATION OF PATENT.

THE hearing of a petition for the prolongation of the patent of 1902, granted to the Runcorn White Lead Co., Ltd., Mr. George Vincent Barton and others, for improvements connected with the production of lead oxide, was concluded by Mr. Justice Sargant in the Chancery Division on May 12th.

MR. FAIRFAX, K.C., with whom was Mr. Moritz, said the subject matter of the patent was litharge, an oxide of lead which had a very extensive application, especially in the construction of storage batteries. This particular substance was also converted into white lead or red lead. Mr. Barton, while manager of the Runcorn White Lead Co., made the invention which was the subject of the patent. Messrs. Rowe Bros. & Co., Ltd., of Exeter and Runcorn, were now the owners of the patent, and though the business carried on under the patent had not up to 1915 been successful, in that year the receipts were greater than the expenditure, and Messrs. Rowe now hoped to turn the patent to advantageous account. They had had to face labour difficulties at Runcorn and heavy cost of freight, besides German dumping and competition among British manufacturers, but they had purchased land at Liverpool and were to erect thereon works on a larger scale for the manufacture of litharge and its conversion into white and red lead, and they expected to save 15s. a ton in respect of freight for raw material and products. In these circumstances Messrs. Rowe and Mr. Barton, who was paid a royalty on the products, petitioned for an extension of the term of the patent.

The Crown, represented by the Solicitor-General, K.C., and Mr. Austen Cartmell, opposed the petition on the ground that the patent was of no commercial value.

At the conclusion of the arguments his Lordship reserved judgment.

HILL *v.* JOHN LYSAGHT, LTD.

IN the King's Bench Division on Tuesday this action came on for hearing.

Plaintiff, an electrical fitter living at St. Albans, claimed to recover damages from defendants for personal injuries sustained through the alleged negligence of a servant of the defendants.

The defendants denied the alleged negligence.

The hearing was adjourned till Wednesday.

BUSINESS NOTES.

Book Notices. — *Electrical Apparatus Making for Beginners.* By A. V. Ballhatchet. London: Percival Marshall and Co. Price 2s. net.—This is an excellent guide for the novice, being obviously written by one who has been through the mill, and knows from experience the troubles and difficulties that will be met with. He recommends a liberal equipment of tools, and with this we cordially agree; but the whole of the work described in this book can be done without a lathe. The construction of primary cells of various types, simple galvanometers, a moving-coil galvanometer, a rheostat, electromagnets, bells and indicators, a Morse sounder and key, simple motors, an induction coil, telephones, voltmeters, &c., is clearly explained, with great detail, on the basis of the author's own work, and we think the ambitious amateur will find the book of the greatest interest and value.

The Arc is "a magazine written and edited by No. 3 Coy. L.E.E., R.E (T.)," at its station on the coast; it has reached its fourth issue, and is going strong, with numerous advertisements, and all the usual symptoms of prosperity. We have been turning over the pages of the last three issues, and note that the contents are varied in the extreme, brightly written, and full of local and topical interest, while the many jests are proof of the cheery spirits of our comrades on active service. The following specimen of frightfulness occurs in a column of queries: "What condition the editor must have been in to spell Mesopotamia, Messupathomehere?" Nevertheless, we congratulate the producers on the energy and originality displayed in their scanty leisure, and wish success to their lively magazine.

"Scientific Papers of the Bureau of Standards." No. 273: General Design of Critically-damped Galvanometers. Washington: Government Printing Office.

Sale of Tyneside Plant.—MESSRS. D. H. LONGBOTHAM & CO., LTD., of Ings Foundry, Wakefield, have purchased from the Newcastle-on-Tyne Electric Supply Co., Ltd., several Parsons turbo-alternator sets, with condensers, &c., ranging from 2,500 to 5,000 KW. These sets are being taken out for the sole reason that it is necessary to make room for larger sets, consequent upon the continued development of the company's undertaking.

Trade with Russia.—THE RUSSO-BRITISH TRADE EXCHANGE, LTD., 16, Regent Street, London, announce that they are taking steps to establish in Moscow a series of exhibition showrooms and salesrooms, with Anglo-Russian technical and clerical staffs, for the representation of British and Colonial manufacturers and merchants on a co-operative basis. The details are set forth in a circular which has just been issued.

Stoker Contracts.—We have received a list of contracts for stokers recently received by the UNDERFEED STOKER CO., LTD. Among these are many contracts for municipal corporations, a number of collieries in this and other countries, mills, ironworks, &c., also the Midland Electric Corporation for Power Distribution, and the Compagnie Generale de Distribution Electrique, Billancourt.

The National Electrical Code 1915.—The office of H.M. Trade Commissioner in Canada has forwarded copies of the "1915 National Electrical Code." This Code has been adopted by the Canadian Fire Underwriters' Association, and British firms are notified of the necessity of complying with the requirements of the Code before undertaking the sale of their goods in the Dominion of Canada. A few copies of the Code are available for distribution to United Kingdom manufacturers of electrical apparatus, and they may be obtained by such manufacturers on application to the Commercial Intelligence Branch of the Board of Trade, London, E.C.—*Board of Trade Journal.*

For Sale.—The City of Leeds Electricity Department has for disposal 1,000-B.H.P. triple-expansion, 3-cylinder vertical Bellis engine, 2 sets horizontal surface condensing plant, with pumping and circulating engines, six 700-KW. two-phase alternators and exciters, and one additional circulating engine.

A sale by public auction, by order of the liquidator of the Consolidated Diesel Engine Manufacturers, Ltd., and Diesel Engine Co., Ltd., will be held at the Ipswich Works, Hadleigh Road, Ipswich, by Messrs. Wheatley Kirk, Price & Co., on Wednesday, June 7th, of the stock of Diesel engines, spare parts and stores.

For further particulars see our advertisement pages to-day.

Advance in Prices.—THE WALSALL ELECTRICAL CO., LTD., announce that, from June 1st, their prices will be increased by a further 10 per cent., owing to the heavy increase in cost of labour and material.

Canadian Trade.—The Ottawa correspondent of the *Times* states that a Commission of six leading Canadian business men is to visit Great Britain, France, and Italy, to study ways of developing Canadian commerce. The Commission may be accompanied by Sir George Foster, Minister of Trade and Commerce. Sir George Foster has arranged with the British Board of Trade to have sent to Canada a display of German and Austrian products to be exhibited in leading Canadian cities. He is making plans for the encouragement of chemical and industrial research work in Canada, with the co-operation of the Universities and chemical societies.

Dinner.—The employés of MESSRS. H. T. BOOTHROYD, LTD., electrical engineers, Bootle, sat down to dinner together on Saturday, May 6th, at the Bear's Paw Restaurant, Liverpool. The guest of the evening was Mr. J. H. Woolliscroft, who has just resigned from the position of general manager, in order to commence business on his own account. Mr. Woolliscroft was presented with a silver rose-bowl and a silver match-box, and, in response, he suitably expressed his appreciation. For a concert which followed, the talent was provided by a number of the employés.

Liquidations. — BALDUR ENGINEERING AND SUPPLY CO., LTD.—A meeting of creditors is called for May 22nd, to accept the resignation of the liquidator, Mr. H. C. Caley, who is now on active service abroad, and to appoint Mr. J. W. Buck, of 39, Victoria Street, S.W., in his place.

BIDDLE AUTOMATIC SIGNAL, LTD.—This company is winding up voluntarily with Mr. W. Braby, 25, Victoria Street, S.W., as liquidator. A meeting of creditors is called for May 22nd.

UNIVERSAL CHEAP CABLES, LTD.—A meeting of creditors is called for May 16th, at 30, Bush Lane, E.C.

COLSTON ELECTRICAL WORKS, LTD.—A petition for the winding up of this company presented by Haslam & Stretton, Ltd., Cardiff, creditors, will be heard at Bristol on May 31st.

R. E. CONNOLD, "late electrician," carrying on business at Canterbury, now R.N.A.S.—Receiving order made May 11th on debtor's petition.

LANCASHIRE MOTOR AND ENGINEERING CO., LTD., Preston.—First meetings of creditors and contributories, May 25th.

Bankruptcy Proceedings. — Arthur Faraday Hawdon, electrical engineer, Yetholm, Elmfield Gardens, Gosforth, Northumberland.—The application for discharge of the above-named debtor was fixed for May 11th, at the County Court, Westgate Road, Newcastle-on-Tyne, but was withdrawn. Bankrupt not to be at liberty to apply again without the leave of the Court and notice to the Official Receiver and payment of the costs.

Trade Announcements.—Mr. R. E. Connold, electrician, of 6A, The Parade, Canterbury, having joined the Forces, has discontinued the business. The stock is to be sold by auction on May 23rd.

The firm of H. Hartjen & Co. has been turned into a private limited company under the title of Holder, Harriden, Ltd. Mr. F. W. Lang is the sole director.

Messrs. A. Hurst & Co., announce that their address is now again, 59, Farringdon Road, London, E.C.

Catalogues and Lists.—Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—Sixteen-page publication in which Mr. L. M. Waterhouse gives an illustrated account of the protective coverings of Simplex conduits—their new "Zenex" and "Negrex" finishes. The former is a pure zinc covering, and the latter is a pure zinc finish subsequently treated with enamel. The firm have recently installed at their Birmingham works what is said to be probably the largest automatic plant in the kingdom for dealing with the deposition of pure zinc on the surface of steel conduits. It is claimed that the extra expense involved in initial outlay will be more than compensated by the increased life and freedom from faults and breakdowns. "Simplex" fittings are finished in exact conformity with the "Zenex" and "Negrex" finishes of the conduits.

"Z" Electric Lamp Manufacturing Co., Ltd., Southfields, London, S.W.—Three book-markers are being issued to the trade generally as part of the company's publicity measures relating to "Z" lamps.

Mr. C. E. Miller, New York.—Catalogue and price list of automobile and other like supplies.

LIGHTING AND POWER NOTES.

Accrington.—Loan Sanctions, &c.—Ald. Higham, the chairman of the Electricity Committee, referring to the loss of £3,410 on the electricity undertaking last year, following a loss of £3,670 in the previous year, pointed out that they were losing money on the contracts made before the war. He was sanguine, however, that their finances would improve considerably during the coming year. They had made out their case, that the load on their station was such as they could not cope with without the extension of plant. The B. of T. had intimated that on formal application, sanction would be given to borrowing £7,000 for a new chimney, boiler, and flue to the destructor plant, and £14,000 for new electrical generating plant, cooling tower, boiler and feed pumps.

Australia.—The *Australian Mining Standard* states that there is every likelihood of the proposed electric light and power scheme for Ipswich (Q.) being carried out, if the Queensland Treasurer agrees to allow 12 months' grace to the company, in view of the difficulties arising from the war. The terms of the Order-in-Council granting the concession stipulate that the period shall not exceed 25 years, and that the local authorities and probably the State Government shall have purchasing rights at the end of 15 years and 25 years, under certain conditions. The price to be charged to local authorities for tramway supply is to be £5 per KW. of maximum demand per annum plus ½d. per unit, and for the city pumping plant, should the city decide on electric pumping, ¾d. per unit plus a reasonable KW. charge. The municipal authorities have agreed not to exercise their purchase rights before 25 years, and to request the Minister to grant the 12 months' grace asked for.

Barnes.—Owing to the fact that the net profit (£769) on the electricity undertaking for the past 12 months is not sufficient to meet all eventualities, more especially as in the eight years immediately prior to the war the average net profit amounted to £2,500, the electrical engineer suggests that as from the June quarter an amount equivalent to 10 per cent. should be added to all accounts. This proposal would, the engineer states, provide a sum of approximately £1,250, and provided the cost of materials remains the same, would ensure a net profit of about £2,000 for the year 1916-17. The Lighting Committee will consider the question at its next meeting.

Canada.—The Court of Appeal has upheld the claim of North Vancouver municipality for power to expropriate the electric distributing system within its borders, this being part of the B.C. Electric Railway Co.'s system.

A bill has been introduced in the local legislature of New Brunswick to permit the development of electrical energy from the St. Croix River.

Continental.—Spain.—A new central station has just been inaugurated in Segovia by the Sociedad Co-operativa Electra Segoviana, a company supplying light and power. The first equipment comprises two hydroelectric groups of Francis turbines, built by Escher, Wyss & Co., and two alternators furnished by the Swedish General Electric Co.—*Industria e Invenciones.*

Dover.—Loans, &c.—The Loaning Authority has agreed to renew for five years, at 5 per cent., the loan of £157,000 for the electricity undertaking.

Gravesend.—Proposed Loan.—The T.C. has decided to approach the L.G.B. with regard to a loan for an electric supply to the Town Works, Northfleet, of the Thames Metal Co. The estimated outlay is £3,000, and the company guarantees for three years a minimum annual payment of £400. Without any guarantee, the company now pays over £2,000 a year for current supplied to its Rotherhithe works.

Great Harwood.—Prov. Order.—The U.D.C. has instructed its clerk to apply to the B. of T. for the renewal of the E.L. order.

India.—Rangoon Street Lighting.—The chief engineer of the Rangoon municipality, while in England, will inquire into the various systems of street lighting. The need for this has arisen from the fact that the present electric lighting of Rangoon is not considered satisfactory by the Municipal Committee.—*Indian Engineering.*

Kendal.—The T.C. has offered to supply current for power, during the present year, at 1¾d. per unit, to Messrs. Atkinson & Griffin, and Mr. H. J. Croft, if each guarantees a consumption of 8,000 units during that period.

Knottingley.—Prov. Order.—The B. of T. has extended the Electric Lighting Order for one year from July, 1916.

Leigh.—Loan Sanction.—The T.C. recently applied for permission to borrow £18,300 for extensions at the electricity works, and sanction has now been received for the borrowing of £5,536. It appeared that if the full scheme had been sanctioned there would have been danger of men being drawn from more urgent work.

Lincoln.—Revised Prices.—The various firms taking power under contract have agreed to pay the increased price for electricity decided upon by the T.C. some weeks ago.

Llanfyllin.—Public Lighting.—With reference to the offer of Mr. R. A. Jones to light the town by electricity, mentioned in the last issue of the Electrical Review, the T.C. has decided to take the opinion of the ratepayers on the matter. The present price of gas is 8½d. per 100 cb. ft., and Mr. Jones offers to undertake the public lighting at a cost which will save 2d. in the pound on the rates.

London.—L.C.C.—The Finance Committee recommends the sanction of the Council to the borrowing of £3,000 by the Hammersmith B.C. for electricity mains, transformers, switchgear and house services; and of £3,000 by the Hampstead B.C. for purchase of a new switchboard.

Stoke Newington.—The Electric Lighting Committee recommends the installation of surge arresters at the electricity substation, at an estimated cost of £61.

Shoreditch.—Loan Sanction.—The L.C.C. has advised the B.C. that it is prepared to advance the £2,000 required by the electricity department for house services and meters, and the B.C. has been recommended to take up the loan. The B.C. is making representations to the B. of T., the Railway Executive Committee, and the Admiralty Coasting Trade Office on the matter of coal supply.

Westminster.—The City Council has been recommended to agree to the increase in charges for electricity supplied by the Charing Cross and St. James's Companies to the Council Buildings.

Middlesbrough.—The Electricity Committee has decided to extend the supply to a large local works.

New Zealand.—The installation of the Kaponga Town Board's hydro-electric plant was expected to be completed last month; the township is situated on the Kaupokonui stream across which a concrete dam has been built. The plant consists of a single-discharge horizontal-shaft type Boving turbine capable of developing 70 B.H.P., coupled to a 45-KW., 230-volt dynamo; a D.P. battery of 128 cells, and about 2 miles of pole line. The system is two-wire D.C., with the street lighting on a separate circuit.—*Commonwealth Engineer.*

Licences have been granted for electrical installations and lines in Thames County, in the borough of Spreydon, in Kidnapper survey district and in Mangohua County.—*Board of Trade Journal.*

Pendlebury.—The new power station which has been erected and equipped for the Acme Spinning Co., Pendlebury, is expected to be running by the end of the present month. The firm has used electricity for driving purposes for several years at the No. 1 Mill, and now the electric drive is being adopted at the firm's other factory, the whole of the power to be derived from its own power station. Hitherto the electric supply for the newer of the two mills has been obtained from the Lancs. E.P. Co. The B.T.H. Co., of Rugby, has supplied the electrical machinery.

Rochdale.—Extensions and Loans.—The recommendation of the Electricity Committee that sanction should be sought from the L.G.B. for the borrowing of £60,900 for extensions at the electricity works was considered at a special meeting of the T.C. on May 11th. Councillor Walker said the Committee did not propose to spend the whole of the money now or in the immediate future. The outlay proposed now was on a new chimney, economiser, induced draught plant, and other work, estimated to cost about £10,000. The other money would be spent as required, and the Council would be able to consider the development step by step. An amendment that borrowing powers be sought to carry out the portion of the scheme stated to be urgently required—No. 3 chimney, induced draught plant and economiser—was adopted by 22 votes to 10.

In a supplementary report on the electricity undertaking, Mr. S. L. Pearce (Manchester City electrical engineer) recommends that the question of a further increase in the prices charged for current should be considered.

Swansea.—Public Lighting.—The Electricity Committee has approved the proposal of the engineer to change over the whole of the existing enclosed arc lamps to incandescent lamps.

West Hartlepool.—Year's Working.—It was reported last week that the income from the Corporation electricity undertaking for the past year showed a net increase of £1,295, chiefly from power supply. The income from public and private lighting was greatly reduced. The expenditure increased by £1,023, the principal item being for the purchase of coal. After meeting all expenses there was a credit balance of £316, against £44 in the previous year.

Worcester.—Loan Sanction.—The T.C. has received permission from the L.G.B. to borrow £240 for the extension of the supply to the works of Messrs. Heenan & Froude.

TRAMWAY and RAILWAY NOTES.

Astley.—Owing to the extension of coal mining in the Astley district, the South Lancs. Tramways Co. is being urged to extend its system in this area.

Birmingham.—The Corporation tramways last year carried 14 million more passengers than in the previous year, and the traffic revenue increased by £125,000.

Bury.—Year's Working.—The total mileage worked by the Bury cars in Bury and adjoining areas, during the year ended March 31st last, amounted to 1,549,366, and 15,810,869 passengers were carried. The gross traffic receipts in the several areas, were: Bury, £45,837; Radcliffe, £14,361; Heywood, £7,438, and Salford, £1,986, making a total of £69,622, as compared with £68,908 in the preceding year. The total receipts amounted to £69,792. The financial result showed a net surplus of £18,334, of which £7,315 represented the net profit on the Bury undertaking, after paying £1,645 war allowances. The profit was allocated as mentioned on page 482. The Bury generating station supplied 1,404,707 units, and the Radcliffe station 389,014 units, the energy consumption showing a slight increase per car-mile, owing to the lack of skill of the new men, while the price of electricity has also been increased by 10 per cent. Mr. Clough, the manager, points out that of the estimated life of the rails, 15 years, about 12 have now expired, and that the period for renewals is fast approaching. A fund of £30,000 is available for this purpose.

Canada.—According to the statement of the general manager of the Western lines, the Canadian Pacific Railway is still considering the electrification of its lines through the mountains of the British Columbia division. The matter has, of course, often been mentioned before.

East London Railway.—Assessment.—The electrically-operated East London Railway, which is worked by a joint committee of six companies, and runs from Shoreditch, under the river, to New Cross, has for the last 30 years been assessed at a figure varying from £2,000 to £8,000. The joint committee, which had unsuccessfully appealed to the London Quarter Sessions on four previous occasions, has now, on its fifth appeal, obtained a reduction on rateable value from £5,092, recently fixed by the Assessment Committee, to a nominal figure of £100. The Assessment Committee was ordered to pay the joint committee's costs.

Heywood.—Year's Working.—There was a loss of £518 on the tramway undertaking during the past year. In the previous year there was a loss of £1,042.

Leeds.—Tramway Goods Traffic.—The annual report on the Corporation tramways points out that since October the tramways have been used for carrying fireclay across the city for a local firm. Mr. Hamilton (the manager) has been asked to report fully on the possibility of using the tramways for goods traffic, particularly those in the northern area, which is unserved by railways or canals.

London.—L.C.C.—The following comparative statement shows the income and expenditure relative to the working of the Council's tramways in respect of the two years, 1914-15:—1914, income £2,268,669, expenditure £1,615,466; 1915, income £2,399,847, expenditure £1,700,572. The expenditure for the year ended March 31st, 1915, includes a charge of £42,209, in respect of allowances made to officers and employés of the tramway department serving with H.M. Forces. The surplus on (working) revenue account for the year 1914-15 amounted to £699,276; the net revenue account showed a deficiency of £33,173, which was met out of the balance standing to the credit of the general reserve fund.

The Finance Committee has had under consideration the question of the periods to be allowed for repayment of capital expenditure in connection with the substitution of turbine sets for reciprocating plant at the Greenwich generating station, and after conferring with the Highways Committee and with the approval of the Treasury, recommends for:—

Expenditure on river works, foundations for new machinery, and alterations to buildings (for completion of works of a permanent character (£23,640)—60 years.

Other alterations to existing buildings (£1,310)—25 years.

Expenditure on new plant and machinery (other than additional steam, exhaust, feed condenser, &c., pipes)—15 years, on the understanding that, in the event of payments into the renewals fund on the agreed basis being resumed at any future date, the question of the period for repayment shall be reviewed.

Expenditure on additional steam, exhaust, feed condenser, &c., pipes—25 years.

Cost of re-blading turbines and re-winding generators to be charged to revenue account or renewals fund.

Outstanding debt in respect of each of the old machines—to be provided for in two years, from the end of the financial year during which the old machine in question is replaced.

The Highways Committee during the quarter ended March 31st, 1916, has settled 483 claims against the Council in respect of accidents arising in connection with the working of the Council's tramways, amounting to £6,478. In 22 other cases actions were brought against the Council. In 13 of these a verdict against the Council was given, and sums amounting to £1,023 and costs had to be paid. The remaining nine actions resulted in the Council's favour; £584 has been received in settlement of claims made by the Council in respect of damage to tramway property.

Luton.—Assessment.—In November last the Commissioners of Taxes dismissed the T.C.'s appeal against the assessment of the Corporation for income tax under Schedule D in respect of the rent received from the tramway lessees (Messrs. Balfour, Beatty & Co., Ltd.) A claim was thereupon made that the Council should have an allowance made for depreciation. The lessees contended that they alone were entitled to the depreciation allowance, but after protracted negotiation an arrangement has been made with the lessees and the Inland Revenue authorities, whereby the Corporation shall have the benefit of so much of the usual depreciation allowance as will release the Corporation from the payment of income tax except to a small extent during the two last years of the existing lease.

Nelson.—The Tramways Committee has decided to have five additional cars fitted with new bodies by the United Electric Car Co., of Preston.

Plymouth.—Electric Vehicle.—The City Council has decided, by 29 votes to 20, to purchase an electric lorry at a cost of £1,055.

Ramsbottom.—Wages.—The Traction Committee has refused to grant an application of the tramway men for an increase of wages, on the ground that the present rate of pay is equal to that paid to drivers on small tramway systems like that of Ramsbottom.

Rochdale.—Three persons were injured as the result of a tramway smash on Friday, last week. A car in Drake Street got out of control owing to the failure of the brakes on the greasy rails, and collided with two coal carts, subsequently running into a double-deck car. Several passengers received a shaking.

Southampton.—Year's Working.—The tramway manager strongly recommends the levying of a charge for excess luggage on the cars, that is to say parcels other than personal luggage not exceeding 28 lb. in weight. For the twelve months to March 31st last, the receipts of the undertaking amounted to £78,064, an increase of £10,022 compared with the previous year. There was also an increase in the number of passengers carried to the extent of 2,228,651, although the mileage run fell short of the figures for 1915 by 66,929. There was a decrease of 4,499 units in the energy used. The receipts, passengers carried, and units consumed per car mile all show an increase as compared with twelve months ago, the former by 1·862d., the second by 1·675d., and third by .045d. The manager is to report upon the penny sections, and as to the advisability of revising them.

Southend-on-Sea.—The Light Railways Committee has instructed the electrical engineer not to proceed with the proposal for engaging women as temporary drivers, but to apply for the exemption provisionally of 17 motor-men, and to appoint temporarily other suitable men for the season traffic when the necessity arises. The Committee has considered the question of the fares at present charged on the tramways, and the rates charged for the supply of energy, but has decided to make no alteration at the present time.

Salford.—War Bonus.—A recommendation has been put forward that female conductors shall be paid the same bonus as males for similar duties.

Swansea.—Extension of Time.—The Tramways Committee proposes to instruct the town clerk to make application for an extension of time for the construction of the Carmarthen Road and Port Tennant Road tramways.

U.S.A.—Electric Freight Yards.—The detailed plans of the West Side Improvement in New York city, which have been filed by the New York Central Railroad, include the electrification of the company's 12-mile freight entrance to the city, and extensive track reconstruction work, involving the covering of the tracks through several miles of parks, at an approximate cost of $50,000,000. Particular interest attaches to the work because of the large scale of the freight switching operations which will be involved; there are four important freight yards on the route. The trains will operate on either 1,200 or 600 volts, and the locomotives will be insulated for 1,200-volt operation, according to the company's practice in connection with its recent passenger locomotives. The locomotives will be available for either 1,200 or 600-volt working; it is expected that 75 will be required, and these will handle two classes of service, viz., through freight trains and switching service. Under present conditions trains of 3,000 tons are handled, but most of the trains are 1,500 tons or less in weight. Much of the traffic has to be handled at relatively high speed on account of the dense passenger traffic on the New York Central's electrical route to which the West Side tracks connect. The road locomotives will operate between New York and Croton, the northern end of the present electric zone, a distance of 34 miles. A new 20,000-kw. turbine set will be installed in the company's Yonkers power station which supplies this section of the railway, and three substations will be provided for the new electrical lines.

A new public service terminal building has been opened in Newark, N.J., which is stated to have cost $6,000,000. Electric cars enter the terminal from the east over an elevated structure and from the west through a subway. The ground floor or concourse contains public gas and electric showrooms, &c., while the upper floors contain offices. The terminal is connected with surrounding districts by 10 lines, and has been provided to accommodate this traffic and prevent interference between it and local traffic.

West Hartlepool.—Year's Working.—To the Corporation, last week, it was reported that the past year's revenue from the tramways was £19,482, against £19,506 in the previous year, the working expenses being £13,126, as against £11,574 in the preceding 12 months. Notwithstanding the increase in working expenses, a sum of £1,278 was carried to the reserve fund, making the total amount of that fund £5,706.

It was reported that an application from motormen and conductors for an increased war bonus, had been referred to the Management Sub-Committee.

TELEGRAPH and TELEPHONE NOTES.

Marconi Station in Danger.—The Dublin correspondent of the *Daily Telegraph* states that a large body of rebels plotted to seize the Marconi station at Skerries, county Dublin. The local police got word of the attack on Easter Tuesday; there was only a small military force at the station, but every preparation was made to meet the attack. On Wednesday the rebels captured the villages of Swords and Donabate, and prepared to march on Skerries, but just then a destroyer came along and landed 200 men, who at once entrenched themselves around the station. The rebels, on learning of the presence of the destroyer, went off in the direction of Dublin.

Spain.—The city of Seville possesses a telephone system, but the municipal authorities have refused to extend it beyond the bounds of the city. An interurban company serves the principal provincial capitals of Spain; but its system has no direct connection with the urban system. Now it is suggested to combine the urban and interurban systems, and to extend the interurban system to the cities and towns in the neighbourhood of Seville. In the six provinces adjacent to that of Seville there is a population of 5,170,000 inhabitants, with 48 important cities and 319 of lesser grade. The Interurban Co. which is studying these extensions is the Compania Peninsular de Téléfonos Interurbanos. —*Industria e Invenciones.*

United States.—The annual report of the directors of the American Telephone and Telegraph Co. (the Bell system) states that at the end of 1915 there were over nine million stations connected, an increase of half a million; the total mileage of wire in use was 18½ million miles, 93 per cent. being of copper, and 10½ million miles are underground, the total cost of the underground conduits and cables being 41 million pounds sterling. The length of phantom circuits in use amounted to 196 841 miles; this item is reported this year for the first time. The effect of adopting phantom circuits is to obtain three speaking circuits from four wires, and it is possible to use two phantom circuits in like manner for a super-phantom called a "ghost," giving 7 circuits from 8 wires—but this is not used commercially, as the gain does not justify the added complications. The daily average traffic in 1915 was 26 million messages, making the immense total of 8 652 million effective connections per annum, exclusive of all uncompleted calls. The expenditure on capital account during the year was 6½ millions sterling, compared with 10 millions in 1914. Provision for depreciation of plant absorbed 9 millions, an average of 5·2 per cent. on the cost of plant, it being a firm policy of the company to provide each year out of revenue a sufficient amount to cover the estimated wear and tear, obsolescence, and inadequacy of plant accruing during that year, so that when any plant has to be superseded sufficient reserve is available to meet the resulting loss of capital. This is the only way in which present telephone users can be made to pay for the wear of the plant they are using.

The total capital expenditure of the system amounts to no less than 273½ million pounds sterling.

During the year trans-Continental communication was accomplished, and the service proved so satisfactory that the work of extending the improved form of construction was at once put in hand. It is now possible to talk from any State in the Union to at least some point in any other. The engineering department also succeeded during the year in transmitting speech by wireless telephony from Arlington, Virginia, to California, Paris, and Hawaii, and the transference of the speaking vibrations from wire to space, and *vice versâ*, was also achieved. As regards the possibility of wireless telephony ever taking the place of wire telephony, the engineers of the company emphatically state that, so far as present knowledge and indications are concerned, there is no such prospect.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—June 20th. Municipal Council. Two-ton electric lorry. City Surveyor, Town Hall.

Melbourne.—June 14th. Victorian Railways. Electric lamps and lampholders for signal system.*

Bedford.—May 25th. Coal for the Corporation Electricity Works; Mr. Chas. Stimson, Town Clerk.

Belfast.—May 24th. Electricity Committee. Chain-grate mechanical stokers. See "Official Notices" May 12th.

Keighley.—May 22nd. Wiring of Fever Hospital and Sanatorium, Morton Banks. Specifications (10s.), Mr. H. Webber, Borough Electrical Engineer, Coney Lane.

Liverpool.—May 31st. Liverpool Overhead Railway. Twelve months' supply of electrical fittings. Particulars from General Manager, 31, James Street.

Manchester.—May 23rd. Coal (best steam cobbles). Tramways Committee. J. M. McElroy, General Manager, 55, Piccadilly.

May 26th. Electricity Committee. Stores for one year. Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

New Zealand.—June 23rd. Oamaru Borough Council. Overhead mains and street-lighting equipment (Contract No. 2); power-station equipment (Pelton wheels, alternators, &c.) (Contract No. 3); service meters (Contract No. 4); line transformers and accessories (Contract No. 5).*

Pahiatua.—July 10th. Borough Council. Overhead wires, poles, street lamps, gas engines, producers, dynamos, auxiliary apparatus and accumulators. Specifications from Borough Offices or E. J. Fenn, Consulting Engineer, Auckland.*

Rochdale.—May 24th. A 110, economiser; A 111, electrically-driven induced draught; A 112, chimney and flues; A 113, ash-handling plant. Specifications, &c., £1 1s., from Mr. C. C. Atchison, Engineer, Dane Street.

Spain.—Municipal authorities of Almorox (Province of Toledo). Tenders for the concession for the electric lighting of the town during six years.

May 30th.—Municipal authorities of Figueras (Province of Gerona). Tenders for the concession for the electric lighting of the town during five years.

May 31st. Municipal authorities of Adradros (Province of Segovia). Concession for the electric lighting of the town during ten years.

Swindon.—May 30th. Corporation. Steam coal for the electricity works and waterworks respectively. See "Official Notices" May 12th.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Government Contracts.—List of new contracts for April, 1916:—

WAR OFFICE.

Distribution boards.—Dorman & Smith, Ltd.
Battery boxes.—Hewson Manufacturing Co., Ltd.; Marshall, Sons & Co., Ltd.; Ransomes, Sims & Jefferies, Ltd.
Bridge meggers.—Evershed & Vignoles, Ltd.
Electric cable and wire.—Craigpark Electric Cable Co., Ltd.; General Electric Co., Ltd.; Johnson, Matthey & Co., Ltd.; Johnson & Phillips, Ltd.; Liverpool Electric Cable Co., Ltd.; St. Helens Cable & Rubber Co., Ltd.
Electric cranes.—Babcock & Wilcox, Ltd.
Electric secondary station.—D.P. Battery Co., Ltd.
Electrolysers and accessories.—Mather & Platt, Ltd.
Engines, dynamo, switchboard, &c.—Petters, Ltd.
Generating sets.—Austin Motor Co., Ltd.
Electric lamps.—Honig & Mock, Ltd.
Switchboards.—Drake & Gorham, Ltd.
Works services.—Electric equipment for power house, British Westinghouse Electric & Mfg. Co., Ltd.; electric lighting, telephones, &c., T. Clarke & Co.; electric lighting installations (various), T. Clarke and Co.; G. E. Taylor & Co.; Ellis & Ward, Ltd.; Foote & Milne, Ltd.; S. Dixon & Son, Ltd.

INDIA OFFICE STORE DEPARTMENT.

Backs and cups.—Bullers, Ltd.]
Cells.—Siemens Bros. & Co.
Elements.—General Electric Co., Ltd.
Engines.—Lancashire Dynamo Co.
Switchboards.—Eckstein, Heap & Co.
Transformers.—British Electric Transformer Co., Ltd.
Wire.—T. Bolton & Sons; Shropshire Iron Co.; Callender's Cable Co., Ltd.

POST OFFICE.

Electric lighting, Bolton new Post Office.—Grindlay, Ross & Co., Ltd.
Testing apparatus.—General Electric Co., Ltd.
Telegraph cable.—Telegraph Construction & Maintenance Co., Ltd.
Telephone cable.—London Electric Wire Co. & Smiths, Ltd.; Telegraph Construction & Maintenance Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Telephone cords.—London Electric Wire Co. & Smiths, Ltd.
Insulators.—Doulton & Co., Ltd.; Taylor, Tunnicliffe & Co., Ltd.
Telegraph ironwork.—Bullers, Ltd.
Glow lamps.—British Thomson-Houston Co., Ltd.; Edison & Swan U.E.L. Co., Ltd.; General Electric Co., Ltd.
Bronze wire.—F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths).

Hants.—The Hants County Council has entered into an agreement with the Chloride Electrical Storage Co. for the maintenance of the storage battery at the Park Prewett Asylum for ten years from the date of its first charge, for £61 a year.

Kirkcaldy.—Council. Electricity meters for one year. Chamberlain & Hookham, Ltd.

London.—L.C.C.—The Highways Committee has accepted the under-mentioned tenders for the supply during 1916-17 of tramways equipment, &c.—

Electrical equipment (motor and generator) spares.—A. Clare & Co. (six months only); British Westinghouse Electric and Manufacturing Co., Ltd.
Electrical equipment (controller, circuit-breaker and other switch details, and magnetic brake) ares.—British Westinghouse Electric and Manufacturing Co., Ltd.
Contact fingers and parts, segments, &c.—British Westinghouse Electric and Manufacturing Co., Ltd.; Dyer & Young; E. Showell & Sons, Ltd.; Tramway Supplies, Ltd.
Electric cable, fuse wire, and cotton-covered wire.—Liverpool Electric Cable Co., Ltd.; Callender's Cable and Construction Co., Ltd.; British Insulated and Helsby Cables, Ltd.; London Electric Wire Co. and Smiths, Ltd.
Copper bonds.—Watlington & Co.
Moulded insulators.—British Westinghouse Electric and Manufacturing Co., Ltd.; Crystalate Manufacturing Co, Ltd.; Ebonestos Manufacturing Co., Ltd.; Litholite, Ltd.
Track insulators and porcelains for electric track work.—Bullers, Ltd.; Taylor, Tunnicliffe & Co., Ltd.
Machined bronze bearings.—Anti-Attrition Metal Co., Ltd.
Brake shoes.—Pease & Partners, Ltd.

Malvern.—U.D.C. Contract renewed for a year for electric meters with the Electrical Apparatus Co.

Southend-on-Sea.—Light Railways Committee. Material for the fixing of the new overhead equipment on the Leigh route:—

D. B. Rose.—Ears, £49.
R. W. Blackwell.—Strainers, wire bolts, and mechanical frog, £25.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, May 19th. At 6 p.m. At Great George Street, S.W. Paper on "Spur-Gearing," by Mr. D. Adamson.

Royal Society of Arts.—Monday, May 22nd. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor Lecture on "Vibrations, Waves and Resonance," by Dr. J. Erskine-Murray (Lecture IV).

Wednesday, May 24th. At 4.30 p.m. Peter le Neve Foster Prize Essay, on "Zinc, its Production and Industrial Applications," by Mr. J. C. Moulden.

Royal Institution of Great Britain.—Friday, May 26th. At 5.30 p.m. At Albemarle Street, Piccadilly, W. Lecture on "X-rays," by Prof. C. G. Barkla, F.R.S.

NOTES.

Resuscitation After Electrical Shock.—In the *Electrical World* Mr. W. P. Strickland recently wrote as follows:—Recently one of our foremen after climbing a pole preparatory to stringing primary wires received a shock that caused him to fall to the ground. It is inferred that in adjusting his belt and shifting his position his spur cut out, and that to save himself he instinctively reached out and touched the wires carrying 2,300 volts. When the other linemen and ground hands reached him to all appearances the man was dead. One of the linemen, following instructions, immediately took hold of the ankles of the limp body, lifting it until the whole weight rested on the neck and then letting it fall. He then took a pair of connectors and hammered the soles of the injured man's feet without removing his shoes. Another lineman opened the man's mouth, pulled forward the swallowed tongue (which occurs in electric shock) and was about to begin the Schaefer prone method of resuscitation when the man returned to life. He was removed to the hospital and is alive and well to-day, though suffering severely from his burns.

For the past year the writer has been teaching his men to strike the feet without removing the shoes in all cases of electric shock. Some years ago an accident occurred where a man came in contact with 6,600 volts, fell from the pole, and was restored to consciousness by this means, although he was terribly burned and died three days later. Another accident that came to the writer's attention happened in New Jersey when a man came in contact with a wire carrying 2,200 volts. This man was struck violently on the feet, his tongue was pulled out, and he was restored to consciousness before the arrival of the doctor.

A Canal Comedy.—The *Times* has received from a correspondent copies of a correspondence which would be merely amusing if it did not reveal a lack of serious thought and energetic enterprise on the part of some of those who are responsible for the working of canals in this country. It appears that the South Metropolitan Electric Light and Power Co. wanted to avoid paying the high freight for the carriage of coal from the north, and inquired of the Grand Junction Canal what facilities that company could offer. A reply was received stating that as the company was not a carrier, the letter had been passed on to a canal carrier. A discouraging note was appended to the effect that it was practically impossible to bring coal from Yorkshire collieries to Greenwich. A letter to the Regent's Canal Co. brought forth a reply in which the writer gave his enthusiastic blessing to the scheme, but said that the matter had been referred to another canal company which, owing to its greater length of waterway, ought to be more interested. Another difficulty arose at this stage owing to one of the canal companies suggesting that it might be necessary to tranship the coal at Brentford, as it was rather dangerous for the canal barges to venture so far down the river as Blackwall. Meanwhile, communication having been established with the canal carrying concern, it was learnt that the canal carrier had died, and his executors, after carefully examining the position, had come to the conclusion that no further work could be undertaken owing to the extra demand made for boats by the usual traders. The South Metropolitan board communicated further with the canal companies, but so far the only help it has derived from them is a suggestion that it should form a syndicate to buy or build barges!

The Chemical Society and Alien Enemy Members.—As the result of vigorous action on the part of the members, the Council of the Chemical Society called a special general meeting to consider the question of removing the names of nine alien enemies from the list of members; the meeting took place on Thursday last week, when an amendment retaining the names on the list was carried by 93 to 91 votes. The society is constituted by Royal Charter and provided by the nation with free quarters at Burlington House. After a long and heated discussion, the meeting was adjourned, and on its resumption the amendment will be submitted as a substantive motion.

We hardly need remind our readers that it is to the fiendish ingenuity of German chemists that such loathsome devices as poisonous gas, lachrymatory shells, and "liquid fire" are due, and of all classes of German scientists, these have achieved the most brilliant success in debasing their manhood and befouling the fair fame of science in the eyes of the human race.

The Electrochemical Equivalent of Silver.—According to No. 271 of the Scientific Papers of the Bureau of Standards, U.S.A., which deals with the question of inclusions of foreign materials in silver voltameter deposits, the value adopted for the electrochemical equivalent of silver by the London Electrical Congress of 1908 (1·11800 mg. per coulomb) is the closest figure that can be assigned to this constant, and appears to be correct to within a few parts in one hundred thousand; the atomic weight of silver is not known to this degree of accuracy. Taking the present international value of the atomic weight, 107·88, the value of the Faraday is 96,494 coulombs, but for general purposes the round figure 96,500 is recommended.

Longitude by Wireless.—The determination of the difference in longitude between Paris and Washington with the aid of wireless telegraphy, which has been in progress since October, 1913, has been completed. The distance between the stations is 6,175 km. The result, expressed in terms of time, is 5 hours 17 minutes 35·67 seconds, and has a probable accuracy of the order of 0·01 second.

Association of Electrical Station Engineers.—The most active branch of the A.E.S.E. at present is Manchester, which has become concerned with the introduction of female labour into various stations in the district. The following resolutions were passed at a recent meeting.

1. *Attitude of Association.*—That this branch views with extreme disapproval the introduction of female labour into electrical stations unless convinced by the authorities that the same is a military necessity.

2. *Wages.*—That the wages paid for female labour be the same as that to the men displaced.

3. *Guarantees.*—That guarantees be obtained that the positions shall be restored to the men displaced, at the termination of the war.

With respect to No. 3, the chairman of the meeting emphasised the fact that guarantees could only be enforced and maintained by a strong united body of station engineers.

During the last few weeks, the number of members of the A.E.S.E. who are undertaking military and naval service has considerably increased, and very few of these are able to continue their subscriptions to the Association. Some anxiety was occasioned to the Executive. Extra efforts were therefore made to obtain new members, and the result has been extremely satisfactory.

American Electric Cooking Campaign.—A special meeting of representatives of electric stove manufacturers was held at the offices of the Society for Electrical Development, New York, to consider the question of a national electric range campaign; the meeting was preliminary to the appointment of a national electric range committee representative of all electrical interests, and it is considered that the Society for Electrical Development should organise the campaign, collecting and publishing data, advertising, &c. A special committee is to meet at the N.E.L.A. Convention in Chicago to elaborate plans.

Scientific Research in Australia.—At a meeting of the Circle of Scientific, Technical, and Trade Journalists, held at the Institute of Journalists on Tuesday, Mr. Gerald Lightfoot, a member of the staff of Mr. Hughes, Prime Minister of Australia, explained the scheme for the promotion of scientific and technical research which is being developed by the Commonwealth Government. In December last Mr. Hughes stated that the Government was prepared to spend half a million sterling, if necessary, for this purpose, and in January a committee was appointed to draw up a scheme. The proposals of the committee provide for the formation of a Scientific and Industrial Advisory Council of nine members, and an Executive Committee of three, the chairman to be a man of wide experience and proved ability, with a full appreciation of the value of the application of science to industry, and the other two to be men of high scientific standing. These three would confer with the Advisory Council, which would consist of representatives of industry and science, but they would not be obliged to adopt the advice of the Council; they would be free from political control, and would occupy positions similar to those of judges, having salaries of £2,000 to £2,500 a year, and being removable only by a resolution of Parliament.

The Executive Committee would go about the country and ascertain the problems immediately calling for solution; it would then allocate the work of investigation to the existing scientific institutions, laboratories, &c. The Federal Government would furnish liberal grants to defray the cost of equipment and maintenance in carrying out the researches, and it was hoped that by this means it would be possible quite soon to organise and stimulate the development of research in the Universities.

A second object was to establish a Bureau of Information, which should collect information on industrial and scientific subjects and distribute it to manufacturers.

Thirdly, there were certain important fundamental investigations which should be carried out in Australia, and which necessitated the foundation of national physical and chemical laboratories, which would be centralised, and engineering laboratories for which, it was thought, the existing laboratories of colleges, &c., could be utilised. Also an Agricultural Bureau would be established, on the lines of that of the United States, which had proved highly successful.

The whole scheme would be based on co-operation between the Federal and State Governments and Universities, and with the employers' and employés' associations. A stimulus would also be given to the teaching of science in the elementary schools. The scheme had not yet been definitely adopted by the Government, as Mr. Hughes was awaiting information as to what was being done in England and the United States; but an assessment was being made by the Provisional Committee in Australia, and steps were being taken through the colleges and universities to ascertain the problems that were pressing for solution.

An associated proposal was that the formation of a central authority in England was essential to the proper co-ordination of effort, to prevent duplication; it was suggested that an Imperial Bureau of Information should be established to act as a sort of clearing house on an imperial basis. It was considered that co-operation throughout the Empire was indispensable to success.

Charge Dismissed.—At the Salford Police Court, on May 12th (according to the *Manchester Evening News*), Joseph Atkinson, secretary of the London (South-Western) Branch of the Electrical Trades Union, of Salford, was summoned on a charge of wilfully withholding £20, the moneys of the Union. Defendant did not appear, nor was he legally represented, but Mr. J. Brown, general secretary of the Union, said that defendant had admitted the deficiency. The Stipendiary said he could not hold that the money had been wilfully withheld, and he accordingly dismissed the summons.

Engineering Industry in the Economic War.—Mr. T. C. Elder, of the British Electrical and Allied Manufacturers' Association, spoke at a meeting in Glasgow, under the auspices of the Institution of Engineers and Shipbuilders in Scotland, the West of Scotland Iron and Steel Institute, and the Glasgow Chamber of Commerce, on Tuesday, May 16th, Lord Provost Dunlop presiding. Mr. Elder traversed much the same ground as he had covered at similar meetings held in other parts of the country. He summed up what he described as a somewhat straggling address in the form of the following propositions:—

1. That it is necessary for the world's peace that Germany shall be restrained, as far as possible, from retaining her past and present proportion of military power.

2. That to accomplish this it is necessary to cripple her engineering industry, and force her populace into peaceful pursuits.

3. That this end can be attained by an international convention of the Allies and the British Empire.

4. But that it will also need a reconstruction of British trade policy, with special regard to the engineering and allied industries.

5. And such a reform will need to be accompanied by a practical conception of the common interests of all engaged in British engineering trade, and by the exertion of collective power on the part of manufacturers for the development of business abroad.

The author's remarks evoked an interesting discussion, in the course of which Sir Archibald Denny, Bart., Dumbarton, said he had to confess that the attitude of those who said they would never again trade with Germany was not a correct one. But if they did trade with Germany again they should do it with their eyes open and armed to resist insidious trading. He was a born Free Trader, and while there was something wrong with their Fiscal trade relations, he had not quite made up his mind that total exclusion was the best way of dealing with organised dumping. Every trade should organise itself now. His great hope was in the organisation of the employers. The men were fully organised and loyal in one direction, and if they joined up with the employers he had not the slightest feeling of despair. Mr. Murray, chairman of directors, Glasgow Chamber of Commerce, pointed out that at the outbreak of the war there were certain industries essential to this country which were practically controlled by Germany, and commercial men were blamed for want of foresight in allowing the deliberate undermining of our trade, which had been going on for many years. They must all admit the partial justice of that condemnation, but he asked if our commercial men were solely to blame. Personally, he did not think so. It had been the ingenious policy of the German Government to staff their Ministry of Commerce with business men who knew a great deal in the way of getting over difficulties which were inevitable in the opening up of foreign trade. The unanimous opinion of business men was that the Board of Trade was overburdened, and was unable, as at present constituted, to deal promptly with any problems which might arise. They were determined, as business men, to make it clear to the Government that the demands of the business community must have attention. Sir John Cowan (Edinburgh) expressed himself in entire sympathy with the appointment of a Ministry of Commerce, provided they got the right men to manage it. If they did not get the right men they would be no better off than they were now. They, as engineers and business men, had the matter in their own hands. Engineers in this country must wake up and do a great deal better than they had done in the past. He emphasised the necessity for complete organisation. It did not matter what their organisation was. It might be perfect, but unless the management and equipment of their works was right the organisation could not pay. Mr. W. S. Workman (Glasgow) agreed with Sir Archibald Denny. What they had seen and heard within the past six months made one think that they would have to change their minds and introduce some new machinery in the shape of tariff reform. They realised that Parliament could do a great deal for them if the Government would only go in the direction business men wished. Another speaker drew attention to what was being done in the United States in preparation for the coming economic war. A naval consulting authority had secured the co-operation of the five national engineering societies, whom they had asked to appoint a representative from each State, who was charged with the preparation of an inventory. That was their first step towards industrial preparedness. Such a system might with advantage be copied in this country.

On the call of Mr. W. W. Lackie, the speaker was thanked.

Prospects in South Africa.—A correspondent inquires whether any of our readers can give information as to the present prospects in South Africa for a man, as described below:—

Sound knowledge of electrical engineering, both theoretical and practical. Undoubted business ability, though the latter has not been developed by actual experience. Born in Holland, of Dutch parents, but father of English descent; name English; married into English family. Speaking, reading, and writing, almost like a native, English, Dutch and German; French also very well. A very important question is: Would those who know advise a man to go out to South Africa with his family "on spec"?

[Perhaps some of our readers will kindly assist our correspondent, who, it will be seen, is of Dutch nationality.]

America's Electrical Week.—This is the title selected for a great electrical celebration, after the style of the "Electrical Prosperity Week," which is planned for December 2nd to 9th, 1916; a start has already been made with the preparations, under the guidance of the Society for Electrical Development.

Appointments Vacant.—Meter and mains assistant for Rotherham Corporation electricity works; mains engineer (£156), for the Borough of Eastbourne Electricity Department.

Educational.—MANCHESTER MUNICIPAL SCHOOL OF TECHNOLOGY.—We have received the prospectus of summer evening classes, which were to begin this week; they include mechanical, electrical, and municipal engineering, chemical technology, &c. Prof. Miles Walker is at the head of the electrical engineering department.

SHEFFIELD UNIVERSITY.—One of the bequests contained in the will of the late Sir Edgar Allen was a legacy of £32 000 to the University of Sheffield, of which £5,000 is to be allotted to the Applied Science department, the remainder being devoted to providing scholarships. Sir Joseph Jonas, chairman of the Applied Science Committee, has added another £5,000 to the legacy, and the total sum of £10,000 is to be used in erecting a laboratory for testing engineering materials.

IMPERIAL COLLEGE OF SCIENCE.—Yesterday a party of Members of Parliament was conducted over the College by the Rector, Sir Alfred Keogh, and the Commercial Committee of the House of Commons, in order that the members might be shown the original research work which has been done at the College in connection with industry.

Fatalities.—An inquest was held at Fence Houses (County Durham) on Monday, touching the death of Henry Allison (25), who was killed electrically on the previous Friday while following his employment as a cleaner-out in the Lady Ann coal mine at Lambton. Deceased was found dead, his body being in contact with the frame of an electric coal-cutting machine. The jury found that death was due to an electric shock accidentally received through contact with the framework of a coal-cutting machine, which was "alive" due to a fault in the cable.

John James Jevons (16), of Droylsden, was killed through falling into a coal hopper at the Manchester Corporation electricity works. At the inquest on Monday it was stated that it was not a boy's duty to go into the hopper, and that it was customary for anyone going into the hopper to have a rope tied round his body. The youth had been told not to go into the hole, but he simply laughed and went down.

Volunteer Notes.—1ST LONDON ENGINEER VOLUNTEERS.—Orders for the week by Lieut.-Col. C. B. Clay, V.D., Commanding.

Monday, May 22nd.—Technical for Sections 1 and 2, No. 3 Company, 46, Regency Street, S.W.; Squad and Platoon Drill, Sections 3 and 4, No. 3 Company; Signalling Class and Recruits.

Tuesday, May 23rd.—School of Arms, 6 to 7; lecture, Mr. J. Roberts, "The Geology of Otford," 7.15; Recruits, 7.15 to 8.15, Archbishop's Park.

Wednesday, May 24th.—Platoon Drill, No. 2 Platoon, No. 1 Company.

Thursday, May 25th.—Platoon Drill, No. 6 Platoon, No. 2 Company; Shooting for Sections 3 and 4, No. 3 Company, Miniature Range; Recruits, 5 45 to 7.45; Instructional Class, 5 45.

Friday, May 26th.—Technical for Sections 3 and 4, No. 3 Company, 46, Regency Street, S.W.; Squad and Platoon Drill, Sections 1 and 2, No. 3 Company.

Saturday, May 27th.—Route March: Parade, Golder's Green Station, 2.30; Uniform.

Sunday, May 28th.—Entrenching at Otford: Parade, Victoria Station (S.E. & C. Railway Booking Office), at 8.35 a.m.

Musketry.—For Nos. 1 and 2 Companies, see Notice and Tables A and B, at Headquarters.

Notice.—Unless otherwise indicated, all drills, &c., will take place at Chester House.

MACLEOD YEARSLEY, *Adjutant.*

3RD BATT. (OLD BOYS) CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Capt. R. J. C. Eastwood (Commandant), Thursday, May 18th, 1916:—

Week-End Parades.—Saturday.—The Battalion will Parade at Baker Street Station, at 2.30 p.m., and proceed by train to Wembley Park for Drill under Company Officers.

Sunday.—The Battalion will Parade at Liverpool Street Station (Low Level entrance, G.E.R.), at 9.30 a.m., and proceed by train for Entrenching duties.

Derby Recruits.—Members called up under Lord Derby's scheme are requested to send in their names to the Adjutant before 9 a.m. on Saturday next, the 20th inst., with a view to application being made for them to serve together in the same Battalion.

Musketry.—The range at Bisley will be open to members. Morning train, 9.20 a.m., Platform 6, Waterloo Station. Afternoon train, 12.45 p.m., same platform.

A. G. JOINER, *Major and Adjutant*, O.B.C.

Institution and Lecture Notes.—Illuminating Engineering Society.—The report of the Council for the past year states that the membership has been maintained. The Presidents of the Institutions of Gas and Electrical Engineers, Mr. John Young and Mr. C. P. Sparks, have consented to act on the Council. The Interim Report of the Committee on Research was presented at the annual meeting last week, and contained a long list of subjects on which research was desirable.

Association of Mining Electrical Engineers.—At the last meeting of the Yorkshire branch, Mr. J. W. Harbottle read a paper on "The Winkey Detector" for earth faults.

Daylight Saving.—On Wednesday the Summer Time Bill received the Royal Assent, and the Act will come into force next Sunday morning, when the clocks on all railways and in Government buildings, and public clocks generally, will be put forward one hour. The "summer time" will remain in force up to and including September 30th.

Enemy Firms.—In reply to a Parliamentary question, the President of the Board of Trade says that he is aware that lists of enemy companies have been published in Australian journals. The names of companies and firms in this country ordered to be wound up are given in the *London Gazette*, and he does not think it advisable to publish the names of other companies and firms in which there are enemy interests, on account of the injustice which would result in certain cases to the British shareholders, and the undesirability of damaging a business when the enemy interest may be transferred to British subjects.

Engineers and the War.—At the annual meeting of the Institution of Engineers and Shipbuilders of Hong-Kong on March 31st, Prof. C. A. Middleton-Smith, the president, delivered an address, in which he referred to the part that engineering and engineers were playing in the war, to the achievements of British engineers in all parts of the world in the past, and to their intentions for the future. In alluding to the future course of trade in China, he emphasised the advantage that would ensue from Chinese and British co-operation in utilising and developing the great mineral and other resources of China. The speaker also referred to the great commercial struggle that would commence when the war was over. Engineers must inevitably take a great part in that struggle, and they must carry out the British tradition and play the square game. The meeting accorded a hearty vote of thanks to Prof. Middleton-Smith upon his retirement from the presidency.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Mr. G. H. BROWNE, acting engineer and manager, Ilkeston tramways and electricity department, has been appointed engineer and manager to the Mexborough & Swinton Tramways Co.

Mr. E. FISHER, junior assistant and temporary mains superintendent in the Nelson electricity and tramways department, has resigned on receiving an appointment at Heywood.

The Ashton T.C. last week adopted a recommendation of the Tramways Committee that the salary of Mr. ERNEST HOLT, manager of the tramways department, be increased from £200 to £260 per annum.

Dover T.C. has appointed Mr. A. H. JONES as a charge engineer at the electricity works. The mains superintendent, the senior charge engineer, and the works superintendent at the electricity works have been granted 10 per cent. increases of salary on account of the high cost of living.

Roll of Honour.—Private G. B. WIVELL, of the Royal Fusiliers, who has fallen in action, was at the time of his enlistment on the staff of the British Westinghouse Electric and Manufacturing Co., Ltd., at Manchester. Just before the outbreak of war he was engaged for the firm at Johannesburg.

Private A. E. TAYLOR, of the 2nd Leicestershire Regiment, who is reported killed in action, after being missing since May 15th, 1915, was, prior to joining the regiment, on the electrical staff of the Holwell Ironworks, Asfordby, Melton Mowbray. He was 26 years of age.

Rifleman H. A. CLARKE, of the Machine Gun Section of the Rifle Brigade, who was, at the outbreak of war, on the Rugby staff of the British Thomson-Houston Co., Ltd., has lost his life at the Front in a mine explosion.

Sergeant J. HINDLE, of the Lancashire Fusiliers, formerly a member of the staff of the British Westinghouse Co., Trafford Park, has been killed. Deceased was 34 years of age, and he has left a widow and five children.

Lieutenant EDWARD WILSON, South African Infantry, whose death is reported, went out to South Africa after taking his degree at Cambridge, and, through an introduction to Rhodes (says the *Times*) was placed in charge of the transport of the Transcontinental Telegraph Co., on the section from Chindi, on the Zambesi, to the north end of Lake Nyassa.

The *Times* states that Captain R. J. SMITH, Lancashire Fusiliers, who fell on May 5th, was an Associate of the Royal College of Science, Ireland. When the war began he was in the service of the British Westinghouse Co., Manchester, before which he had been a teacher in Newry Technical Institute.

General.—The Post Office Provincial Superintendents and the Headquarters Staff of Traffic Managers have now been amalgamated into one establishment, under the control of Mr. R. A. DALZELL, with the title of Chief Inspector of Telegraph and Telephone Traffic. His two principal assistants will be Mr. L. HARVEY LOWE, late Deputy Controller of the London Telephone Services, and Mr. J. LEE, with the title of Deputy

Chief Inspector of Telegraph and Telephone Traffic. Mr. W. A. VALENTINE, late Provincial Superintendent, has been appointed Deputy Controller of the London Telephone Service.

Mr. J. W. TURNER, Post Office engineer of Darlington, has retired after 45 years in various positions in the Post Office Telegraph Service. His late colleagues presented him with a draught screen and other gifts Mr. Turner, in replying, recalled the occasion when he attended the first telephone experiment by Sir W. Preece at the Guildhall, Plymouth.

Obituary.—MR. EDWIN THORNTON.—At the funeral, at Barrow-in-Furness on Saturday last, of the late Mr. Edwin Thornton, A.M.I.E.E., whose untimely death occurred as the result of a motor-car accident on the road near Carnforth on April 29th, those present included Ald. J. P. Smith, Chairman of Barrow Electricity Committee; Mr. Wm. Drysdale, A.M.I.E.E., representing the Barrow Chamber of Trade; representatives of the Barrow Technical Schools and Barrow Master Builders' Association, &c. The deceased, who was 50 years of age, and eldest son of the late Mr. W. R. Thornton, was managing partner of the firm of Messrs. W. R. Thornton and Son, electrical engineers. The deceased's only son is in the Army in Egypt.

MR. RICHARD S. BLACKBURN.—Mr. Richard S. Blackburn, electrical engineer and contractor, of Hebden Bridge (Yorks.), died suddenly on May 8th after undergoing an operation. He was 54 years of age.

MR. EDGAR W. SALIS.—According to the *Times* "Deaths" column, Mr. Edgar W. Salis, representative at Rio, Brazil, of the Marconi Co., third son of the late Major-General Salis Schwabe, C.B., died in London last week aged 41.

LADY CROOKES.—Lady Crookes, wife of Sir William Crookes, O.M., passed away last week at the advanced age of 80 years. We tender our sincere sympathy to Sir William in his loss.

MRS. WORDINGHAM.—The many electrical friends of Mr. C. H. Wordingham will regret to learn of the death, on the 11th inst., of his mother, the widow of the late W. H. Wordingham. The loss of a parent is one of those misfortunes which no one may hope to escape, but in some cases the blow is heavier than in others; and without intruding too far into so delicate and personal a subject, we may venture to say that it is an open secret amongst his intimate friends that to his mother Mr. Wordingham ascribes all that he has achieved—to her he looked for sympathy, inspiration, and encouragement, and he looked upon her as a true comrade. We sincerely condole with him in his bereavement.

MR. W. DEAN.—The death is notified of Mr. W. Dean, assistant electrical engineer with the Merthyr Electric Traction Co., Ltd. He was 28 years of age, and in the new year had a serious attack of pneumonia.

PRIVATE G. L. F. EDWARDS.—Private G. L. F. Edwards, of the King's Shropshire Light Infantry, who has lost his life through the accidental discharge of a revolver, was, prior to the war, engaged as an electrician with Messrs. Lea & Son, electrical engineers, of Shrewsbury. He was the son of Capt. Geo. Edwards, of the same regiment, and had been at the Front since last July.

NEW COMPANIES REGISTERED.

British Graphite & Trading Co., Ltd. (9,597).—This company was registered, in Edinburgh, on May 13th, with a capital of £12,000 in 8,000 participating pref. shares of £1 each and 80,000 ord. shares of 1s. each, to carry on the business indicated by the title. The subscribers (with one pref. share each) are: J. Logan, 95, Bath Street, Glasgow; J. J. Fisken, 20, West Campbell Street, Glasgow. Private company. The number of directors is not to be less than two or more than seven; the first are J. Logan and J. J. Fisken. Qualification, 200 shares of either class. Remuneration, £100 per annum. Solicitor: D. Gardner, Glasgow. Secretary: A. Grimmont. Registered office: 53, Bothwell Street, Glasgow.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Wakelins, Ltd.—A memorandum of satisfaction to the extent of £120 on April 15th, 1916, of debentures dated May 7th, 1914, securing £720, has been filed.

Brilliant Arc Lamp & Engineering Co., Ltd.—Memorandum of deposit on April 25th, 1916, charged on certain contracts, to secure all moneys due or to become due from company to London & South-Western Bank, Ltd., 170, Fenchurch Street, E.C.

Llandrindod Wells Electric Light & Power Co., Ltd.—Particulars of £3,200 debentures, created December 11th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.—Particulars of £400,000 debentures, created March 16th, and secured by trust deed dated March 28th, 1916, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital and land, buildings, and premises in West Ham and Liverpool. Trustees: J. S. Cockburn, J. Ferguson, Sir Henry C. Mance, Kt., C.I.E., and Hon. S. E. Marsham.

Willans & Robinson, Ltd.—Debenture dated April 28th, 1916, to secure £20,000 (ranking *pari passu* with a debenture £40,000 issued in December, 1911), charged on the company's undertaking and property, present and future, including uncalled capital, subject to prior charge. Holders: G. H. D. Coates, Rugby, and W. C. Buckley, 71, Lombard Street, E.C.

Ernst Hildebrandt, Ltd. (112,286).—Capital, £5,000 in £1 shares. Return dated March 16th, 1916. All shares taken up; £1 per share called up on 4,002 shares; £4,002 paid; £998 considered as paid. Mortgages and charges:- Nil.

W. T. Glover & Co., Ltd. (56,124).—Capital, £214,850 in £1 shares (100,000 pref.). Return dated April 24th, 1916. 100,000 pref. and 114,850 ord. shares taken up; £1 per share called up on 67,000 pref. and 50,000 ord. shares; £117,000 paid; £97,850 considered as paid on 33,000 pref. and 64,850 ord. Mortgages and charges: £192,800.

CITY NOTES

General Electric Co. (U.S.A.)

The following particulars appear in the income account of this company for 1915, as published in the *American Electrical Review and Western Electrician*:—

	1915.	1914.
Sales billed	$85,522,070	$90,467,692
Costs, including operating maintenance depreciation charges	76,898,183	81,496,728
Profit	8,623,887	8,970,963
Interest and sundry revenue	2,129,266	1,570,431
Income from securities	1,554,843	1,313,989
Total income	12,307,996	11,855,383
Debenture interest	570,086	567,556
Net profit	11,737,910	11,287,827
Dividends	8,129,919	8,142,867
Surplus	3,607,992	3,145,060
Previous surplus	20,084,879	16,939,819
Profit and loss surplus	23,692,871	20,084,879

The net profit was equal to 11.56 per cent. earned on $101,510,600 capital stock, against 11.12 per cent. earned on $101,485,700 stock in 1914.

In his remarks to stockholders, Chairman C. H. Coffin said that the value of orders received by the company for electrical apparatus and devices in the past year was $98,385,891, an increase of $14,637,370, or 17 per cent. over those of 1914. This increase was largely due to the general revival of business in the latter part of the year. "These figures are exclusive of orders for special war munitions, which amounted to $33,980,000 during 1915. These have been so restricted as to interfere as little as possible with the regular product of the company. The percentage of profit from these orders will probably be less than that of the average of the company's output. The amount of sales billed was $85,522,000, a decrease of $4,945,621, or 6 per cent." The number of employés engaged in the factories and offices, and in those of subsidiary companies at the end of 1915 was about 60,000. The company has followed its customary practice in writing off against income account its total expenditures in 1915 for patents, applications for and licences under patents, and other outlays relating thereto, amounting to $838,455. The patent account is carried at $1, as in previous years. Stocks, bonds, and other securities are carried at a valuation of $32,916,593, of which $19,687,965 represents securities of subsidiary companies, and $13,228,628 those of public utility and other companies. Current accounts and notes receivable are carried at $19,619,215. Sales of several small factories substantially offset the manufacturing floor space added in 1915; and plant expenditures amounting to $4,485,068 were chiefly for improvements in existing construction and equipment, and the purchase of special tools and machinery which are subject to a high rate of depreciation. Because of the nature of these expenditures, and on account of the liquidation of the book value of the factories sold, the reduction in the plant account for the year was $5,985,068.

German Electrical Companies.

The Concordia Elektrizitats Ges., of Dusseldorf, which is now associated with the Berlin-Hagen Accumulator Co., records net profits of £8,600 for 1915, as compared with £12,000 in 1914. It is intended to pay a dividend of 7½ per cent., as against 10 per cent. in the previous year.

The Berliner Elektrische Bahnen, whose share capital of £300,000 is held almost entirely by the City of Berlin, propose to pay a dividend of 1 per cent. for 1915, as in the previous year. The directors state that they hope soon to be in possession of new motor tramcars in order to enter into competition with the Grand Berlin Tramways.

The report of *Korting & Mathiesen, of Leutsch, near Liepsig* (arc lamps and electricity meter works) states that Army contracts were only carried out to a limited extent in 1915, but activity in all departments was satisfactory, and the turnover was greater than that in the preceding year. After providing for depreciation, the net profits are returned at £10,500, as compared with £9,200 in 1914, and the dividend at 5 per cent. is the same rate as in the previous twelve months.

The Elektrizitats Lieferungs Ges., of Berlin, after reporting that the development of the supply industry in 1915 was hampered by the unfavourable situation of the times, states that the production of the works owned by the company, and of others in which it is also interested, increased by 3,240,000 KW.-hrs. to 55,672,000 KW.-hrs. As net profits, the accounts indicate the sum of £169,000, as contrasted with £179,000 in the previous year, and the dividend in contemplation is 10 per cent., as in 1914.

The accounts of the *Bergmann Elektrizitats Werke A.G., of Berlin,* show gross profits amounting to £1,061,000 for 1915, as compared with £555,000 in the previous year. After deducting general expenses and interest charges, and setting aside £313,000 for depreciation, as against £158,000 in 1914, the net profits are returned at £573,000, as contrasted with £198,000. It is proposed to pay a dividend of 10 per cent., as compared with 5 per cent. in 1914, to place £50,000 to a goods reserve account, £200,000 to the war and war tax reserve account, and £2,500 to the benevolent funds, and to carry £19,000 forward to 1916.

French Electrical Companies.

The Compagnie d'Electricité de Limoges earned gross profits amounting to £31,000 in 1915, and net profits of £20,000. It has been decided to pay a dividend of 6 per cent. on the ordinary shares and set aside certain sums for the renewal of batteries, redemption of loans, &c.

The Société Francaise des Electrodes has declared a dividend at the rate of 16s. per share out of net profits amounting to £12,700 in 1915. It was mentioned at the recent general meeting that, notwithstanding the scarcity of labour, more satisfactory results could be expected for the current year.

The Union Electrique, whose revenue experienced a large decline in 1914-15 as compared with the preceding year, reports gross profits of £22,000, as against £36,000 in 1913-14. After defraying general expenses and financial charges, the net profits of £192 have been carried forward, this result contrasting with a dividend of 2 per cent. which was paid for 1913-14.

The Compagnie l'Energie Electrique du Sud-Ouest reports a large increase in the receipts in 1915, and net profits and balance forward amounting to £52,000. A dividend at the rate of 5 per cent., or £1 per share, has been declared. During the year extensions of the works were undertaken in order to cope with the growing demand, and an investigation is being made with a view to the utilisation of two new falls on the Dordogne, between Tuilere and the Mauzac barrage.

The Compagnie Francaise Thomson-Houston reports a gross revenue of £301,000 for 1915, as compared with £302,000 in the previous year, of which £209,000 and £204,000 were derived from manufacturing and sales in the two years respectively, and the balance from investments. After meeting general expenses, financial charges, and placing £72,000 to the depreciation fund, the net profits and balance forward are returned at £127,000, or practically the same as in 1914. It is intended to distribute £1 per share on the ordinary capital, being the same rate as in 1914.

Calcutta Electric Supply Corporation, Ltd.

At the annual meeting held on May 11th, the Chairman (Mr. P. V. Luke, C.I.E.) said that the capital expenditure during 1915 was £122,344, compared with £61,443 in 1914, the increase being chiefly on account of a new 6,000-kw. turbo set installed at Cossipore; the mains laid in connection with the supply of current to the docks of the Calcutta Port Commissioners; switchgear for the new sub-stations; and the ordinary expansion of the business. The total generation costs increased by £4,906, mainly owing to the larger quantity of coal used, 5½ million additional units having been generated. Revenue expenditure was practically the same. Revenue from sale of current showed a satisfactory increase of £24,404. Meter rents were reduced by one-half last July. The war tax of 50 per cent. on excess profits affected, or would affect, them seriously, although their excess profits were accounted for entirely by the growing expansion of the business, and were in no way due to the war. On the contrary, the business was adversely affected by the greatly increased cost of materials and transport. If their additional profits were in any way due to the war no exception could be taken, but on a business in a state of development it fell with a severity which hardly appeared equitable. There was no desire on their part to make a grievance of having to assist in the prosecution of the war. They had carried forward a much larger sum than usual in order to provide for the tax, which had now been increased to 60 per cent. Another matter of importance was the increase in the ordinary income-tax, which in India had been more than doubled, being raised from 5 pies in the rupee to 12 pies, or one anna; while the English income-tax would be for the current year 4s. 6d. in the £, and they had to pay both the Indian and the English tax. Moreover, an *ad valorem* import duty, on goods imported into India, had been imposed, which would affect them in the current year to the extent of 7½ per cent. on cables and 2½ per cent. on machinery. At the last two annual meetings he had alluded to their intentions to make certain reductions in the charges to their consumers in Calcutta. Consistent with their duty to their shareholders, they had ever before them the desire to make the supply of electrical energy as cheap as possible, and it was their intention to persevere in that direction. Their average dividend on the total subscribed capital had been 7 per cent., and considering the class of business it could not be argued that they had made undue exactions from the public. In setting aside large sums for reserve and depreciation they had been guided by figures well recognised in similar undertakings in this country, and these were by no means excessive, in fact, probably the opposite. As much as 77 per cent. of their reserve had been derived from premiums on shares issued and interest on investments. In regard to superseded plant, they had spent, roughly, £500,000 in bringing the undertaking up to date. This had necessitated laying aside a large amount of machinery which, though not worn out, was none the less uneconomical for their purposes. Had that plant served its full life the original cost would have been written off against depreciation, but not having served its full life the book value was still quite a large figure, larger than what they would sell it for. They had disposed of a considerable quantity of it, and the difference must be made good out of revenue. They had decided to spread the liquidation of that debt over several years, during which period additional sums, over and above what was required to cover current depreciation, must be set aside before the Corporation could be as generous as it might otherwise be to either its consumers or its shareholders. Therefore the reductions in charges to the public in Calcutta had been as liberal as the position of the Corporation justified. The chairman proceeded to show in detail that the aggregate result of several reductions in 1914 and 1915 in charges amounted to £22,000 per annum. He replied effectively to letters which appeared in the Calcutta Press on the matter of the charges to the public. Considering the unsettled state of the war and its consequences, they had acted toward consumers as liberally as circumstances permitted. Though the war had not affected them in Calcutta so detrimentally as it had done similar undertakings in England, it had not been without its sinister influence. The speaker proceeded to show how prominent members of the staff and others were assisting in the war, the difficulty in obtaining the services of suitable men from England, and the difficulty, almost impossibility, of getting any new plant from English factories. They were fortunate in getting delivery, though belated, of a 6,000-kw. turbo set ordered in December, 1914, from the British Thomson-Houston Co., Ltd., and in having it safely erected in Calcutta. In order to ensure the certainty of a supply of direct current for the auxiliary plant and the station lighting in case of any accident in future which might cause a complete breakdown on the h.t. side, a secondary battery had, as a special safeguard, been erected at Cossipore, which had cost, including the switchgear, £3,800. All the pumps, both for air and water circulation, are driven by d.c. motors, and will be kept running by this battery. This will enable the station to be started up again much more quickly, and in the case of a comparatively insignificant failure of the d.c. supply at Cossipore, the battery would probably prevent a total shut-down. The construction of four new sub-stations, badly needed to meet the expansion of business, was put in hand during the year, and one was started up in December. A ten years' contract had been made with the Port Commissioners for a supply of current to the docks. The great distance of the docks from the Cossipore station had involved a large expenditure of capital in mains, which had to be duplicated by different routes so as to ensure a safe supply. Several inquiries received for large extensions pointed to a considerable access of business after the war. There was a further improvement in regard to units unaccounted for. The bonus scheme distribution to the staff in India was £1,629, as against £1,406 in 1914.

Chesham Electric Light and Power Co., Ltd.

The profit for 1915 after paying all charges, including interest on debentures and temporary loans, but exclusive of depreciation, was £1,563. After deducting £500 for depreciation and £152 for proportion of costs connected with the debenture issue, and adding £1,958 brought forward, there is an available balance of £2,870. A dividend of 4 per cent. absorbs £600, and £2,270 is to be carried forward. The gross earnings, exclusive of profits on wiring, have shown a steady increase for the past five years; for 1915 they were £6,315, against £5,085 in 1914. Extensions at Berkhampstead and Amersham had been further proceeded with. The capital expenditure during 1915 was £4,767. The heavier load had necessitated plant, &c., additions at Chesham, which had been fully warranted by the reduction in the cost of the electricity supplied. The bankers' loan had been increased to £4,000, leaving £1,000 still at the company's disposal. It is proposed to write off the remainder of the cost of the debenture issue by six annual instalments of £151. Units generated, 712,641; units sold, 618,067.

Callender's Cable and Construction Co., Ltd.

For the year 1915 there is a balance at the credit of profit and loss of £113,267, plus £163,169 brought forward, making £276,436. From this are deducted: interest on debenture stock, £13,500; preference dividend £10,000; depreciation of buildings, plant and machinery, £10,335; depreciation of office furniture, £254. It is proposed to pay a dividend on the ordinary shares at the rate of 10 per cent. per annum, less income-tax, being 10s. per share; a bonus of 5s. per share and a special bonus of 5s. per share, both less income-tax; and £207,347 is to be carried forward. The year's operations have been carried on under exceptional difficulties as to men, materials, and transport, and the directors are pleased to submit a report which shows such satisfactory results. The company has been a controlled establishment since August last. No firm in the electrical industry has rendered more effective service to the nation. The ordinary home trade has consequently been much interfered with, but it has been possible to carry out some municipal and other contracts in connection with munition work, and also to satisfy to some extent

the demands of the old and valued customers of the firm. The shortage of shipping has seriously interfered with the delivery of orders for overseas customers, but in spite of this, good work has been done in several of the Colonies, and in some of the neutral countries, which will, it is hoped, be of considerable service after the war. It has been necessary to rearrange many of the departments of the factory, so as to adjust them to the new conditions. There have been difficulties in doing this, but the arrangements have now been made in a satisfactory manner, and the works at Erith and at Leigh are fully and most usefully employed. Substantial additions to the plant and machinery at Erith and at Leigh have been necessary, and further additions are being made. The Anchor Cable Co., Ltd., whose operations are so closely interwoven with those of this company, has also been able to show satisfactory accounts of its year's working. The Leigh factory has been running for many months continuously day and night on work on behalf of this company. Both at Erith and at Leigh great difficulty has been experienced in regard to labour, owing to the drain on the available supply for the direct manufacture of munitions, and the large number of the workmen and staff who have joined the Colours. At the Anchor works women have to a large extent taken the place of men, and arrangements are now being made at Erith for the employment of female labour upon an effective basis. Annual meeting: May 25th.

Eastern Extension, Australasia, and China Telegraph Co., Ltd.

The report for 1915 states that the gross receipts amounted to £950,030, against £819,583 for the previous year. The working expenses, including £51,312 for maintenance of cables, absorb £386,672, against £364,978, leaving £563,358, plus £31,371 brought forward. £30,096 is required for interest on mortgage debenture stock and £85,817 for income-tax payable in England and excess profits duty. Three interim dividends of 1¼ per cent. each have been paid, and £200,000 has been credited to the general reserve fund. The directors now recommend a final dividend of 2¼ per cent., with a bonus of 2 per cent., making 8 per cent., free of tax, for the year, carrying forward £38,816. In addition to the £200,000 above referred to, the general reserve fund has been credited with £40,912 in connection with the closing and disposal of the Banjoewangie-Roebuck Bay cable owing to the establishment of improved means of communication with Australia making it unnecessary to continue the maintenance of this cable. On the other hand (says the *Financial Times*), the fund has been debited with £74,685 for partial cable renewals carried out during the year, £11,382 representing the loss incurred on the sale of investments and £25,000 as a further provision on account of investment fluctuations, bringing the total provision against depreciation up to £225,000. An agreement has been concluded with the Australian Commonwealth Government enabling the company to deal direct with the public in Melbourne, as at Sydney, Adelaide, and Perth, and an office has been opened by the company for the reception and delivery of telegrams in Melbourne.

Eastern Telegraph Co., Ltd.

During the year ended December, 1915, the revenue was £2,104,431, less £655,888 ordinary expenses, and £202,609 for expenditure relating to maintenance of cables and other expenses, leaving £1,245,934, plus £32,742 brought forward. After providing for income-tax payable in England and excess profits duty, interest on mortgage debenture stock, and preference dividends, the balance is £821,638, out of which £460,000 has been placed to the general reserve, £10,000 to insurance of war risk at stations fund, and £5,000 to insurance of goods in transit fund. A final dividend on the ordinary stock of 2¼ per cent. and a bonus of 2 per cent. make a total of 8 per cent., free of income-tax, for 1915, and £26,638 is to be carried forward. The general reserve fund has been charged with £204,880 in respect of the new Aden-Colombo cable and other special expenditure, and with £125,000 as a further provision on account of investment fluctuations. At the annual meeting on May 24th shareholders will be asked to approve the payment of the directors' remuneration free of income-tax.

Kidderminster and District Electric Lighting & Traction Co., Ltd.—During 1915 the capital expenditure was £309. The net receipts of the lighting undertaking were £4,561, plus £3,471 dividends received in respect of investments, and £219 brought forward. After deducting administration and general expenses, interest on temporary loans and debenture stock, and providing £500 for renewals, there remains £3,708. Of this, there is to be put to reserve £750, to dividend on cumulative preference shares £1,500, and there is carried forward £1,458. The profit on the working of the tramways company, after providing for renewals, is £2,439, plus £163 brought forward. There has been put to reserve £500, a dividend at the rate of 3½ per cent. absorbs £2,002, and £100 is carried forward.

Stock Exchange Notice.—The Committee has ordered the undermentioned to be quoted in the Official List:—

South Metropolitan Electric Light & Power Co., Ltd.—Further issue of 45,926 six per cent. cumulative second preference shares of £1 each, fully paid, Nos. 350,001 to 395,926.

Craigpark Electric Cable Co., Ltd.—At the annual meeting, in Glasgow, the Chairman said that the year's working had been satisfactory taking everything into consideration. They had been somewhat handicapped by shortness of labour and difficulty in getting delivery of material. They could have done more business but for these circumstances. There had been a big rise in the price of copper, but at present they were fairly well off with regard to purchases. He moved the payment of a dividend of 6 per cent. on both preference and ordinary shares, and, Prof. Magnus MacLean seconding, the report was unanimously adopted.

West Coast of America Telegraph Co., Ltd.—The gross receipts during 1915 were £65,475, as against £61,129 in 1914. The working expenses were £46,215, as compared with £43,054. After deducting £477 for excess profits duty, the revenue account shows a balance of £18,782, plus £1,994 brought forward, making £20,777. £6,000 has been paid for interest on the 4 per cent. debentures, £800 provided for the interest on the 4 per cent. income bonds, £5,000 transferred to the general reserve fund, and £6,000 to the provision on account of investment fluctuations, leaving £2,977 to be carried forward.

South Metropolitan Electric Light & Power Co., Ltd.—There is being offered to the holders of the shares and debenture stock for subscription, £30,000 4½ per cent. first mortgage debenture stock at £85. The issue is necessary owing to the continuous expansion of the business; the stock will rank *pari passu* with the other 4½ per cent. debenture stock, and it is repayable at par on July 1st, 1931, or earlier on six months' notice at £110. Allowing for redemption, the return at the price of issue is about 6 per cent. per annum. The Treasury raises no objection to the issue.

Birmingham District Power & Traction Co., Ltd.—The total revenue for 1915 was £101,909. Surplus, after providing £9,000 for renewals, £58,738. The directors recommend placing to reserve £5,000, a dividend on the preferred ordinary shares at the rate of 4½ per cent., carrying forward £2,551.—*Financial Times.*

Babcock & Wilcox, Ltd.—Speaking at the annual meeting on May 9th, Mr. J. Dewrance said that considering the enormous changes that had taken place since the last meeting, the balance sheet must be a source of great satisfaction. In pre-war days they made boilers, cranes, and conveyors; these were now cast aside, and they were making anything for which their factory was suitable without any stint of labour.

Kalgoorlie Electric Power & Lighting Corporation, Ltd.—The report for 1915 states that the average profit of previous years has been maintained. A further £7,000 has been added to the debenture redemption fund, bringing that item up to £14,000, and, after writing off £6,500 for depreciation and paying debenture interest, the balance carried forward is £1,139.—*Financial Times.*

Submarine Cables Trust, Ltd.—The revenue for the year ended April 15th was £25,489, and the expenses were £1,509, leaving £23,979. After providing £15,843 to meet payment of the coupons, £8,109 has been transferred to the redemption fund, leaving £77 to be carried forward.

Anglo-Argentine Tramways Co., Ltd.—The gross receipts for 1915 were £2,709,616, a decrease of £141,380. The expenditure was reduced by £94,256. No dividend on the ordinary shares is recommended. The credit balance of £91,120 is to be carried forward.

United River Plate Telephone Co., Ltd.—The directors recommend a final dividend of 5 per cent. on the ordinary shares, making 8 per cent. for the year 1915, free of income tax, carrying forward £6,234.

Victoria Falls & Transvaal Power Co.—The financial Press states that the net earnings (including those of the Rand Mines Power Supply Co.) for the quarter ended March 31st amounted to £192,874.

British Electric Traction Co., Ltd.—The directors, according to a financial daily, recommend a dividend of 3 per cent. on the new ordinary stock for the year ended March 31st.

Capital Reduced.—*British Uralite Co.* (1908), *Ltd.*—The Chancery Court last week sanctioned the reduction of capital already referred to here.

Melbourne Electric Supply Co., Ltd.—Interim dividend, 5 per cent., free of tax, on the ordinary stock.

STOCKS AND SHARES.

Tuesday Evening.

One of the principal features in the Stock Exchange market this week is the influence exerted over securities, particularly those of the best class, by the removal of the minimum prices from the pre-ordinary stocks in the Home Railway market. These have been protected in this way, of course, since the Stock Exchange re-opened, last January twelvemonth, and there was considerable speculation in advance as to whether

the freeing this market from the restriction of minimum prices might not drive a blow at other gilt-edged securities.

So far, however, no harm has been done to any of the gilt-edged departments; and the extension of the arena of high-class issues which the development entails has been accomplished without any disturbance to other existing values. Prices in the Home Railway market have fallen from 10 to 20 points, the movement being accompanied, oddly enough, by advances in the ordinary stocks of this market, for which the explanation is adduced that trustees of deceased accounts will now be able to sell prior-charge Home Rails instead of being compelled to limit their realisations to the junior securities.

The railway stocks with which we are more particularly concerned in these columns, to which the minimum prices have applied hitherto, are as follows:—

Stock.	Price. Minimum.	Now.	Fall.
Metropolitan 3½ per cent. debenture	83¼	65	18¼
Metropolitan 3½ per cent. "A"	82¼	64	18¼
District 4 per cent. Prior Lien	92	74	18
London Electric 4 per cent. debenture ...	85	74	11
Central London 4 per cent. debenture ...	93	75	18
Central London 4½ per cent. preference ...	99¾	78	21¾
Metropolitan 3½ per cent. preference	77¼	64	13¼
Metropolitan 3½ per cent. "A"	74¼	64	10¼
Metropolitan convertible preference	74¼	63	11¼

The quotations in the second column—that is to say, those now current—are to some extent nominal even yet, because business is still a little cautious of returning to this market. Holders of the stocks argue that they have perforce kept them for so long that they may as well retain them a little longer, in the expectation of buyers giving more than the figures quoted above. Whether they will be right to refrain from selling, if they really wish to get rid of the stocks, seems to us a little doubtful, unless they are prepared to keep them for some time after the conclusion of peace.

Generally speaking, the best-class debentures have fallen to a level at which they pay 5 per cent. on the money: upon this platform, of course, they stand equal with the Exchequer Bonds of 1920. The preferences are approximately valued by the market upon a 5¼ per cent. basis of yield; and it will be observed that the returns from the stocks, given in our list above, conform roughly to this scale.

With Daylight Saving so close at hand, it would certainly not have been surprising to find most of the electric lighting shares lower on the week. As a matter of fact, however, the only falls are those of ¼ in County of London and in Westminster ordinary shares; while Cities are actually better at 12. There is, perhaps, less reason for dulness in Counties than in almost any other share throughout the list, since the company derives so substantial a part of its profit from supply of current for power that it should be less hit than its peers by the Daylight Saving Bill. The City of London is another concern with a big business amongst power consumers. Edison & Swan of both classes have further receded, their recent dramatic rises being too swift to last; as it is, however, the prices stand substantially higher than they did a month ago.

Anglo-Argentine Tramways continue to give way, and the first preference have dropped to 3½, at which they show a yield of 7⅞ per cent. on the money. Brazil Tractions regained the loss of the previous week, moving up to 56½ in consequence of a recovery in the Rio rate of exchange to a shade above 1s. The principal rises in this section, however, stand to the credit of the British Columbia Electric Railway group, where the deferred is 5 points, the preference 4 and the preferred stock 1 point to the good. Traffics of late show comfortable evidence of amendment, and there is a well-founded impression that the severity of the competition endured for some time past has slackened noticeably of late.

The news from Mexico is scarcely so good just recently, and those who declared themselves buyers of Mexican utilities are exhibiting some little hesitation when a seller comes along. The nominal prices of the securities, however, are unchanged. The Carranzist Government is said to have prohibited the export of silver from any of the Mexican mines, from which the inference is obvious that it is desired to place the terribly depreciated paper currency upon a better basis. This, however unjust to the silver-producing mines of the country, might turn out to be a bull point for the industrial concerns; though, as vigorous protests have been lodged against the proposed prohibition, it may come to nothing after all.

Telegraph stocks and shares are strong, the only exception being West India and Panama ordinary, which have dropped 3/16 on the passing of the dividend. The Eastern Extension report shows splendid results, net profit coming out at £563,000, and the carry-forward of £38,800 being £7,500 more than was brought into the accounts. Anglo-Americans are good, the preferred hardening to par. Globes continued their improvement on the increase in the dividend. In the manufacturing group, Telegraph Constructions gained 10s., and India-Rubbers half as much.

Projectiles, at 20s. for the 1s. shares, are the main feature of strength amongst the armament group. The rubber market is calmer again; business is remarkably quiet in contrast to the rush before Easter. The Commodity market is something of a dark horse at the moment, but share prices are maintained with a good deal of firmness, and buyers from the provinces have begun to re-assert their confidence.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1914.	Dividend 1915.	Price May 16, 1916.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	10	6½	—	£7 8 2
Charing Cross Ordinary	5	5	8¼	—	7 13 10
do. do. do. 4½ Pref.	4½	4½	8¾	—	8 18 6
Chelsea	5	4	8¼	—	6 8 1
City of London	9	8	12	+ ⅛	6 13 4
do. do. 6 per cent. Pref.	6	6	10½	—	5 11 8
County of London	7	7	13½	— ¼	6 16 7
do. 6 per cent. Pref.	6	6	11⅛	—	5 14 3
Kensington Ordinary	9	7	5	—	7 0 0
London Electric	4	3	1⅛	—	7 6 4
do. do. 6 per cent. Pref.	6	6	4¼	—	7 1 2
Metropolitan	3½	3	1⅛	—	6 6 4
do. 4½ per cent. Pref.	4½	4½	8	—	7 10 0
St. James' and Pall Mall	10	8	6	—	6 13 4
South London	5	5	2⅝	—	8 18 10
South Metropolitan Pref.	7	7	1⅛	—	6 14 0
Westminster Ordinary	9	7	5½	— ¼	6 1 9
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	100 xd	+ ½	6 0 0
do. Def.	30/-	33/6	21⅜	+ ⅛	7 13 0
Chile Telephone	8	8	6¼	—	6 8 0
Cuba Sub. Ord.	5	5	7⅜	—	6 18 4
Eastern Extension	7	8	14⅞	—	*5 12 4
Eastern Tel. Ord.	7	8	14⅜	—	*5 11 1
Globe Tel. and T. Ord.	6	7	12½	+ ¼	*5 14 8
do. Pref.	6	6	10½	—	5 17 5
Great Northern Tel.	22	22	3⅝ xd	—	6 0 7
Indo-European	13	13	49	—	6 12 8
Marconi	10	—	2⅜	—	4 11 4
New York Tel. 4½	4½	4½	100⅝	—	4 9 4
Oriental Telephone Ord.	10	10	13⅜	—	5 10 4
United R. Plate Tel.	8	—	6	+	*6 12 0
West India and Pan.	1	Nil	⅜	—	9 6 1
Western Telegraph	7	8	14¼	—	*5 12 4
Home Rails.					
Central London, Ord. Assented	4	4	67½	—	5 18 6
Metropolitan	1¼	1	25¼	—	3 18 6
do. District	Nil	Nil	19	+ ⅛	Nil
Underground Electric Ordinary	Nil	Nil	1⅝	—	Nil
do. do. "A"	Nil	Nil	5/6	—	Nil
do. do. Income	6	6	87	+1½	*6 18 0
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	5½	5½	3½	— ⅛	7 17 2
do. 2nd Pref.	5½	5½	3¼	—	8 9 2
do. 5 Deb.	5	5	78	—	6 8 2
Brazil Tractions	4	4	56½	+1½	7 1 6
Bombay Electric Pref.	6	6	10⅝	—	5 15 8
British Columbia Elec. Rly. Pfce.	5	5	59	+4	9 9 8
do. do. Preferred	—	Nil	40	+1	Nil
do. do. Deferred	—	Nil	88	+5	Nil
do. do. Deb.	4½	4½	62	—	6 17 1
Mexico Trams 5 per cent. Bonds	—	Nil	41	—	Nil
do. 6 per cent. Bonds	—	Nil	35	—	Nil
Mexican Light Common	Nil	Nil	20	—	Nil
do. Pref.	Nil	Nil	32	—	Nil
do. 1st Bonds	Nil	Nil	41	—	—
Manufacturing Companies.					
Babcock & Wilcox	14		2⅝	—	5 14 3
British Aluminium Ord.	5		22/- xd	—	6 7 8
British Insulated Ord.	15		10½	—	7 2 10
British Westinghouse Pref.	7½		44/-	+ 1/-	6 16 6
Callenders	15		11½	—	6 10 6
do. 5 Pref.	5		4¼	—	5 17 8
Castner-Kellner	20		13⅝	—	6 1 3
Edison & Swan, £3 paid	Nil		11/-	— 6d.	Nil
do. do. fully paid	Nil		1⅝	— ⅛	Nil
do. do. 5 per cent. Deb.	5		57	—	* 15 *
Electric Construction	6		16/6	—	7 5 5
Gen. Elec. Pref.	6		9⅝	—	5 4 8
Henley	20		14⅛	—	*6 18 0
do. 4½ Pref.	4½		4	—	5 12 6
India-Rubber	10		10½	+ ½	*9 10 6
Telegraph Con.	20		37	+ ½	*6 16 0

* Dividends paid free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Blackpool-Fleetw'd	April 29	2,768	+ 183	17	6,728	+ 55	8	..
Bristol (Trams)	„ 28	19,921	+ 874	17	77,283	+ 3,592	30·5	..
Cork	„ 27	1,813	— 10	17	7,641	— 12	54·25	..
*Dublin	„ 14	14,071	—1,212	15	87,416	+ 8,402	5·89	..
Hastings	„ 28	4,081	+ 679	..	..	+ 574	19·3	..
Lancashire United	„ 16	7,227	+ 707	17	27,247	+ 1,781	43	..
Llandudno-Col. Bay	„ 28	1,331	+ 99	21	4,584	+ 163	6·5	..
Tyneside	„ 24	9,114	— 151	16	7,888	— 314	11	..
Anglo-Argentine	„ 22	201,146	- 9,685	17	813,468	— 2,993	..	..
Auckland	„ 7	20,767	+ 551	40½	210,704	+ 3,553	25·42	1·08
Calcutta	„ 22	17,694	+1,160	17	..	+ 449	..	..
Kalgoorlie, W.A.	Feb.	2,118	..	..	4,484	..	..	..
Madras	April 30	4,311	+ 280	17	16,764	+ 1,560	..	..
Montevideo	April	28,997	+2,211	26	187,419	+12,764	..	..
Dublin-Lucan Rly.	April 28	564	+ 7	17	2,030	— 154	7	..

* Two weeks.

THE ELECTRICITY SUPPLY OF GREAT BRITAIN.

This subject was discussed at a meeting of the Manchester Local Section of the Institution of Electrical Engineers, the discussion being opened by Mr. J. A. Robertson, who said that the present position of the electricity supply business in this country called for serious consideration in view of the steps which would have to be taken at the end of the war to re-organise and re-establish our national industries. The restrictions placed by the Local Government Board last year on new capital expenditure, coupled with the largely increased output of energy for war munition purposes, had reduced the reserve plant capacity in most central stations to a margin which would have been considered totally inadequate in normal times; the problem of utilising to the very best advantage the existing plant in central stations was, therefore, one that should receive the immediate and careful attention of all interested in electricity supply. The most serious difficulty with which central stations had had to cope during the last year had been the high price and the shortage of fuel supplies. The Prices of Coal (Limitation) Act, passed in July, 1915, conferred an immediate benefit in restricting the inflated prices which were then demanded, but the intention of the Act was not being fulfilled, and large quantities of coal were being sold at prices considerably above the maximum increase of 4s. per ton. The existing conditions called for thorough investigation, and, if found necessary, the Act should be amended to carry out the intention of Parliament. Indirectly, the difficulties under which central stations had been operating would do much good. Manufacturers who were still generating from private plants, or using steam or gas power, had found their power costs increasing by 30 to 40 per cent., while the central-station consumer had not been called upon to pay more than 10 or 15 per cent. increase in the rates for electricity. They had, therefore, the unique position of manufacturers applying for power supplies who were previously convinced they could produce more cheaply with their own plants, while central-station engineers were refusing applications for supply which no amount of canvassing could formerly obtain. The ultimate effect was bound to be beneficial to the electrical industry, and the time was, therefore, opportune to consider steps for improving and strengthening their position after the war. In the paper read by Mr. Williams at the Institution in London, they had Dr. Ferranti's splendid idea for centralising electricity supply put into the form of a concrete proposal. Mr. Williams believed that the time had arrived when a national scheme of bulk supply from large central stations might be introduced which would gradually supersede the inefficient, and in some cases obsolete, stations now in operation. All central-station engineers would agree that centralisation was desirable, but there were certain stages of development to be passed and difficulties to be overcome which were overlooked in the paper. The technical difficulties could not be set aside, particularly the differences in periodicities in various districts.

The present Government control of electricity undertakings by three departments was unsatisfactory, but the proposal to set up a Board which would operate electrical undertakings on such a large scale, and to give the Board powers now exercised by three Government departments, was open to severe criticism. He thought, also, that to place the control of a district comprising, say, the Midlands or the North-West of England, in the hands of one engineer-manager would not commend itself either to engineers or local authorities. The scheme did not propose to interfere with existing undertakings, but simply to set up a trading concern selling electricity in bulk. The power companies had been trying to do this for years, and had made little headway because they found in most cases that bulk supply could not be given to central stations at a price which would pay the standing charges on the necessary cables, converting and transforming plant, and also the standing charges on the superseded generating plant. Again, the Central Board would have no powers to compel a local authority to shut down its generating station, or to fix the price which the existing authorities were to charge for energy. A local authority might, therefore, continue to operate its own plant, and even to pay its extensions out of revenue, or it could purchase energy from the State system in bulk, and resell it at prices which were deliberately fixed high to ensure large profits for the benefit of the district rates. In either case, the object of a bulk supply scheme, *i.e.*, the provision of cheaper electricity for all industrial and domestic purposes, would be defeated. State ownership might be the *ultimate* solution of the all-electric problem, but they would be faced with an enormous difficulty probably in a few months, or, at most, in a year or two, to meet the demand for a cheap power supply which was vitally essential for increasing the productive capacity of manufacturers after the war. Their task for the present was to ascertain what steps could be taken to utilise their *existing* facilities to the fullest extent, taking care only to make extensions or adopt methods which could be worked in as part of a larger scheme, when the time was ripe for it.

The policy of linking up existing undertakings, which had been adopted in one or two London boroughs, would have to be seriously considered. The country for electrical purposes divided itself into eleven areas, which represented the important industrial and coal-mining districts. In each of these districts, the existing central stations could be linked up at a moderate cost. Later on, it would be a simple matter to supply the network thus formed from one or two large modern stations. About 220 generating stations out of a total of 364 in the whole country would be included in those areas. Most of the remainder were in residential districts, and it would not be profitable to connect them to any system of high-tension networks.

As an instance of what linking-up might do, the Manchester district was a striking example. There were situated within the Manchester area 15 generating stations with an aggregate generating capacity of 170,000 kw. Nine of these stations were generating three-phase energy at 50 periods, and there were no technical difficulties to prevent them being linked up immediately. The stations would act as reserves to each other, and the aggregate demand could be increased by 30 to 40 per cent. with perfect safety.

Hitherto, the chief obstacle to co-operation between existing authorities had been local jealousy, but if machinery was put in motion to combine these authorities for a common object this jealousy would probably disappear.

He proposed the formation of a joint board for each district, consisting of representatives elected by the supply authorities, along with a certain number of independent members appointed from the local manufacturers, who were, after all, the parties most interested in the question of cheap power supply.

As the joint board would require to raise capital, Parliamentary powers would be necessary, which might be limited at first to the raising of capital for the consolidation of existing undertakings. The powers might be enlarged later to include the extension of existing undertakings and the building of new stations. By this means they would obtain uniformity in administration, and other benefits, such as standardisation of rates for supply, would naturally follow.

It was not suggested that this proposal would provide a complete solution to the problem, but it would, at least, prove more workable than any nationalising scheme could possibly be at this stage; it could be put into operation with the minimum of cost, and, what was more important at present, with the minimum delay.

He agreed with the suggestion that the powers now vested in the Local Government Board, the Board of Trade, and the Home Office should be combined in a Central Electricity Board. This Board, which would be mainly composed of electrical engineering experts, would be the sanctioning authority for loans, and would, therefore, be able to exercise technical supervision over the proposals of the district boards.

There was another question closely bound up with the centralisation of electricity supply which, unless dealt with on national lines, would prove a serious hindrance to the object aimed at. Oil fuel might be left out of account while they were dependent on foreign markets for supplies. They were, therefore, absolutely dependent for the production of power on the supply of coal. Coal getting and coal distribution were an outstanding example of their haphazard methods in dealing with matters of vital importance. The colliery owner was left free to extract the coal, and to sell it to the highest bidder, even though he were the agent of a foreign Government not too friendly to this country. There was no attempt to grade or classify coal from particular districts for industrial purposes. Prices varied within wide limits, and at one time they were threatened with interruption of supplies through strikes, while at another stocks were held up in order artificially to inflate prices. The time had arrived when a Commission should be appointed by the Government to report on the national supply of fuel with the object of utilising it to the best advantage. The question of transport should also be dealt with, so that they would not witness the anomaly of coals being shipped from Newcastle to Manchester district, whilst collieries within a 20-mile radius of Manchester were actually sending consignments of coal to Newcastle for export. The Limitation of Prices Act would require to be strengthened and compulsory arbitration introduced to prevent an interruption of coal supplies through strikes. To avoid such strikes some form of profit-sharing might be established which would give the worker a direct interest in the concern for which he worked.

These proposals might seem somewhat daring, but if they were to make good the wastage caused by the war and to retain their commercial supremacy, the problem must be dealt with on broad lines. The ideal to aim at was to convert their natural resources, fuel and labour, into power, light, and heat, so as to achieve the highest individual and national efficiency.

If the war caused them to scrap their old methods and to reorganise existing systems with the view of attaining higher standards, the enormous sacrifices which it had entailed would not have been in vain.

Mr. J. S. Highfield said that one of the reasons for the success of electricity supply undertakings was the possibility of working with less coal than the individual manufacturer. He thought it was a mistake originally to grant powers to public companies with terminable concessions, as during the last few years preceding the termination it would be difficult to raise capital for so short a period, and they would not invest their reserve funds freely in the business because of

the doubt as to what they would get for the undertaking when it was sold. When the Power Acts were granted in 1900, that fault in the original legislation was realised, and power companies were formed without compulsory purchase clauses. Even without such a Board as had been suggested, a great deal might be done with regard to linking up, so that the small stations should not be unnecessarily extended. The electrical industry in this matter had suffered from professional jealousy; there had not been that assistance given between managers of supply authorities which would have made connections possible. He had not much belief in Government control, because it was not possible to alter human nature by legislation. The war was going to do a lot for them, and it was making people see that the success of one's neighbour was in a very large measure one's own success.

Ald. W. WALKER said that in principle the linking-up of stations would be a good thing for the community; when, however, details came to be discussed the human element entered into the matter. When dealing with representatives of public bodies and directors of private companies, with their professional and technical staffs, one immediately found that each took a conflicting view as to which was the main concern. At present they were handicapped by having to go to Parliament for permission before a step could be taken to improve the conditions in a given area. There ought to be some body to whom an appeal could be made, who would consider these questions solely on their merits, and not with sentimental or political motives.

Mr. A. E. MCKENZIE said that in Manchester the price of gas had been increased approximately 24 per cent. in the last twelve months, as against 10 per cent. to 15 per cent. for electricity. Mr. Robertson's suggestion that the proposed Board should fix the selling price would involve considerable difficulty, as each municipality had its own ideas as to the amount that the electricity department should contribute to the rates. The Manchester electricity department had for some years contributed a sum of £30,000 per annum in relief of the rates. If it were proposed that the department should be State controlled, he was sure the inhabitants of the city would offer great opposition to the scheme, unless this rate aid was continued. Great economies would be effected if the linking-up of stations was brought about; it was absurd that municipal boundaries should be insurmountable barriers against such a scheme. Professional jealousy also tended against its adoption. It had been done in several London boroughs, with very great saving. In Lancashire it could easily be arranged by the engineers of the various undertakings, and undoubtedly good would result.

Mr. S. J. WATSON thought that one of the great difficulties of a Joint Board would be that of finance. He suggested that the capital might be found partly by municipal bodies and partly by private enterprise. A further step might be taken to appoint representatives from the local Boards to a Central Board in London, which should possess very wide powers. Not the least matter which such a board would have to deal with would be the conservation of coal supply. It would have power to stop the establishment of any further small generating stations, and also to consider the advisability of continuing existing stations or forcing them to take a supply from some other larger undertaking in the district. When Chairman of the Manchester Section, some five or six years ago, he went carefully into the question of linking-up the different stations, and found that if all the supply undertakings within an 8 or 10-mile radius of the city were coupled up, it would set at liberty for use spare plant to the value of approximately half a million of money. He agreed with Mr. Highfield on the question of perpetuity of tenure; if an order was limited, higher prices must be charged than would be the case if the time was unlimited, owing to the uncertainty as to what would happen at the end of the term.

Mr. C. C. ATCHISON agreed that there should be a Central Electricity Board in London, but its functions should be mainly in the direction of finance and general guidance. There should be some standardisation of systems throughout the whole country; at the present time systems were very varied, and it would be difficult to link up the stations in certain areas owing to the difference in frequencies, and so on. With regard to the profits from municipal stations, he thought that the ratepayers were entitled to a reasonable return from their trading undertakings, but not to the extent some of them had contributed in the past. The friction which might exist between undertakings in connection with the linking-up of systems did not, in his opinion, arise from engineers, but was purely a question of local councils. No doubt in the future it would be necessary to link up certain stations, and the engineers were quite willing to consider such a scheme with interchange of supplies regulated in a manner like the railway clearing-house.

Mr. J. H. WOOD thought the time was ripe to consider the question of linking up. This could be done without a Board, by a meeting of the different authorities. Many of the smaller undertakings had found it necessary to limit their undertakings because they could not enter upon any additional capital expenditure until there was some revenue from the capital already expended. Many consumers were lost in this manner. With regard to coal supplies, a Board on the lines suggested by Mr. Robertson could control both prices and quality. He suggested that a Board might regulate the amount to be paid for labour.

Mr. R. BLACKMORE thought there was no good reason why the suggested Board should be formed. It had not yet been shown that super-stations could generate more cheaply than a medium-sized station. Linking-up was good, but it was not necessary to bring in Parliament to do it. Tramways had already been linked up, and electricity stations could be linked up similarly.

Mr. J. D. PATON said that engineers should not confine themselves to pure technical electrical engineering, but study mining engineering, in order to deal with the waste coal and future supplies of coal for electric power. They had millions of tons of waste coal which yielded 40 or 50 gallons of oil to the ton, but the colliery owners could not produce this material till it was demanded. The coal which was now estimated as valuable coal would in the near future be relegated to a position of secondary importance. Coal fired for a thermal value only would become a thing of the past, and take a secondary place to coal which would yield a high oil and by-product return.

Mr. ROBERTSON agreed that the high price of coal was a good thing for electricity undertakings for the time being, and even if it continued, but a broader view should be taken. To re-establish their position after the war in the world of commerce, they must have cheap power, and therefore cheap fuel. It was just because of the human element that it would be necessary, in his opinion, to go to Parliament to obtain powers to over-ride those local councils which might not be prepared to come voluntarily into a local linking-up scheme. He had not proposed that uniform prices should be charged in one district or in one undertaking; he had simply said the Local Board should be the authority that would fix the prices for each area or portion of an area. He thought that was a very necessary thing, because if they were introducing a bulk supply to a group, one local authority might fix prices without any reference to the actual cost, or the actual value to the consumer. He did not think an electricity undertaking existed for the purpose of making money to be handed over to the ratepayers who were not possible consumers of electricity, and who would never be called upon to make good any deficiency that might arise. Any surplus or profits should be transferred to the reserve fund, and so prevent the possibility of the ratepayers being asked to make good any deficiency. The linking-up arrangement he suggested was only a temporary one, to meet the difficulty. His own view was that the powers possessed by these Boards should go much further later on, and would ultimately result, he believed, in the nationalisation both of generation and distribution.

AMERICA AND EXPORT TRADE DEVELOPMENT.

IN the proceedings of the last annual convention of the National Commercial Gas Association of America, there appears a report of an address by Dr. E. E. PRATT, Chief of the Bureau of Foreign and Domestic Commerce of the U.S. Department of Commerce, on the subject of export trade development. He said that at the outbreak of the war much was said about America's exceptional opportunities for securing export trade, but he believed that many such statements were unduly optimistic, being made by persons who were inclined to take an exaggerated view of the possible expansion in the foreign field.

One assertion, however—and it might be regarded, after all, as the fundamental one—was absolutely true. The disturbed conditions in Europe did, and still do, give American manufacturers an altogether unusual opening for the building up of foreign trade. But the expectation of immediate returns, of getting a great number of cash orders in foreign countries, was ill-judged and failed, very naturally, of realisation. There was ground for the belief that many exporters thought they had only to go to South America, to Australia, to South Africa, to Japan or China, and pick up the orders overlooked or left behind by the countries that had become involved in the great military conflagration. Such a view was hardly justified. The European war broke up so completely the machinery of the world's traffic and the world's credit that it was impossible for many months to get orders in foreign countries. It was impossible for many months to get the cash for orders that had been taken before or during that time. The chief advantage derivable by American manufacturers from the unprecedented situation that confronted them at the beginning of the war was the chance to lay a solid foundation for future business. That was still true. The opportunity was not so much an affair of present profit as of earnest, judicious building toward a goal which, while it was clearly discernible, could not be grasped at once. And when this end was finally reached, the accomplishment would be valuable and important just in proportion as the preliminary work had been systematic and well done.

The American manufacturer had, in some ways, been slow to seize the advantage that conditions now afforded. Many were hesitating; they were waiting to see what someone else could do; they were reluctant to extend the necessary credit facilities. But, on the other hand, there were many enterprising, far-sighted manufacturers who had gone into the

foreign markets with vigour at this time. They might not all be taking orders; but they were gradually, surely, paving the way for future trade. He knew one manufacturer who had sent out his salesmen (his business diplomats, they might more properly call them) for the purpose of establishing on secure foundations the business in these foreign countries. He knew of manufacturers who had planned extended campaigns for from one to five or ten years—not with the idea of getting immediate sales or of making marked conquests next year, or the year after, but, rather, of attaining an eventual position that would ensure the coming of a notable volume of business into their hands. Some of them might not realise the increase of American trade with the countries that were entirely outside the war zone. They were enjoying, of course, an augmented trade with the neutral European, as well as with the allied nations. There might not, however, be an adequate comprehension of the way in which U.S. trade with South America, for example, had increased. Comparing the four months—June, July, August, and September, of 1913—with the same four months of 1915, U.S. trade with South America had increased 21.5 per cent. That must be regarded as a considerable increase in a large volume of trade. "Our trade with Central America has, unfortunately, not increased. Our trade with Canada has actually decreased by almost 9 per cent. Our trade with British South Africa has increased 12 per cent. Our trade with Asia has increased 50 per cent., and our trade with Australia has increased by the astonishing amount of 77 per cent. These figures convey, more emphatically than any long analysis, a sense of what has happened in the markets that are not in the zone of military operations."

He did not wish to be understood as discouraging the hopes that had been aroused with reference to the Latin American field, but it seemed worth pointing out that there were markets in other countries that were of equal or greater importance. After all, in all of Latin America, including Mexico and the West Indies, there were 75 million people. But in certain other parts of the world there were tremendous populations—populations capable of absorbing vast quantities of goods. Passing over South Africa and Australia, with populations of 6,000,000 and 5,000,000 respectively, he spoke first of India. India had 315,000,000 people. Its imports in 1913-14 amounted to the total of $594,517,000, of which the United States furnished only $15,542,000. The value of American products consumed annually in India was less than 4 cents per capita. India had been characterised by a recent writer as "the treasure sink," and to an American commercial traveller it seemed like "a bottomless pit, into which supplies may be sent in an endless stream."

The East Indies had 40,000,000 people; Japan had 53,000,000; China had 350,000,000; and last, but by no means least, Russia had 170,000,000. Some of them were thinking that the people of those countries had not the purchasing power of the South Americans. If an individual average were taken, that was indisputable; but the fact should, nevertheless, be stressed that, in the aggregate, countries like India and China had a genuinely enormous purchasing power. In Australia—a field that in many discussions received comparatively scant attention—the average man bought about 50 dollars' worth of goods from the United States every year.

Russia, in his opinion, was perhaps the most promising market to which American manufacturers could just now look forward. It was a great, but largely undeveloped country. In all Russia there were now only about 46 thousand miles of railways; within the next few years, thousands of miles would be built. Only 20 per cent. of the large cities of Russia had either electric or gas plants. Only a small proportion had such public improvements as sewage and water systems. Russian mines, forests, and mineral resources were relatively undeveloped at the present time.

During the last few years Russia had been importing annually, from all the countries of the world, an average of $600,000,000 worth of goods. About half that amount, or $300,000,000, had in the past been sold by Germany. They might decide for themselves whether, after the termination of hostilities, such an amount of goods would continue to be taken from Germany into Russia. Present indications pointed to the probability that the trade would be divided between England and the United States on the west and Japan on the east. A tremendous amount of goods had been flowing from the United States *through* Germany into Russia. Germany, in fact, had acted as the middleman for most of U.S. Russian trade.

Dr. Pratt next glanced briefly at the methods of entering these markets. To one essential principle they might adhere, and that was that foreign was not basically different from domestic trade. They might reasonably expect to succeed abroad if they employed there the same fundamental principles that they had used in the successful development of their business in the United States. To illustrate this, they might cite an example. Suppose an American manufacturer located in New England were about to develop a new market on the Pacific coast. What would he do? Probably his first move would be to go there himself, looking over the field personally, formulating his impressions of it, determining whether there was likely to be a market. Then, quite probably, he would send out his sales manager for the purpose of acquainting himself with the sales methods of his competitors, and with the idea of testing out the market and ascertaining exactly what kind of products should go there. In the event that he represented a large corporation, he would send there skilled business investigators, in order that they might actually go to the consumers, find out what competing products were marketed, and gather together the many facts that a large manufacturer would desire before embarking on an undertaking of that kind. He would then be likely to set aside a small advertising appropriation, not so much with the idea of getting immediate business as of seeing whether the market would respond to methods he had used before—whether, in short, his goods would "go." After satisfying himself on these preliminary points, he would send out his salesmen. Most manufacturers would scarcely expect a group of salesmen in a new territory to show a profit at the end of their first trip. If they turned in profits at the end of a second or third trip, or even a fifth trip, the manufacturer would, in most cases, be satisfied. Later, headquarters, or a branch store or distributing warehouse, would be established in the locality, and finally, perhaps, a factory might be established. How did the same manufacturer approach the subject of foreign trade? He probably got together, in the first place, all obtainable books that had to do with the particular market that he contemplated entering. He sent to the Government for publications, and the Department of Commerce could, as a rule, supply him with interesting literature.

Writing to an American Consul, he might secure a list of all the persons in that district who would be likely to take his goods. His next step was to send out circular letters and catalogues of his goods—printed, perhaps, in English. As a result of these efforts, he might get an order. This he filled. Greatly elated at his success in the foreign field, it was quite probable that he might neglect altogether to look up the purchaser's credit rating—a thing he would not fail to do if he were shipping a bill of goods to Tacoma or San Francisco. Perhaps, finally, he became sufficiently resolute to send out a salesman; but almost invariably (and contrary to his usual custom) he would expect that salesman to show a profit at the end of his first trip.

"We have all heard men say: 'There is nothing in this foreign-trade game. I have tried it. I sent out a salesman, and he made no profits, and I am done with it. I am convinced there is nothing in it.' That is emphatically *not* the way to work up a business in a foreign market. The manufacturer who does business on such principles abroad will fail just as surely as the man whose methods I have previously outlined is certain to succeed in the domestic field. Let me repeat, therefore, the fact that, after all, the same businesslike principles are applicable to the foreign trade as to the trade at home."

Certain modifications were, of course, necessary, but, from the standpoint of general policy, these were of relatively small consequence. A few surface conditions presented new problems; a few obstacles or handicaps must be surmounted; but these things were a matter of detail. In South America, as had frequently been stated, travelling salesmen must possess the qualities of courtesy and politeness; business transactions there rested, in a large measure, on a basis of personal friendship and esteem. And, in addition, the methods were more leisurely; breeziness, hustle, a determination to make a quick sale must yield in those countries to the practice of quietly deferring to the wishes of the buyer. Adjustments, adaptations, must be made in minor matters such as these; the successful exporter and the successful salesman must show a willingness to conform. "But is not the same true, in a less degree, perhaps, of the United States? There are, I think, some sales managers here. Is it not true that you have to do business in different ways in different parts of the United States? Is it not necessary to use different sales methods in New York and in Chicago, in San Francisco and in New Orleans? Before passing on to another phase of commercial life, let me reiterate my conviction that, in so far as your domestic trade methods are sound, logical, and well-considered, they will need no material alterations when brought to bear upon the foreign field."

With respect to co-operative marketing for export, there was really not much that could be said, since information on the subject was more or less limited. The German cartels had been pointed out from time to time as an example of what they ought to do. He thought, however, that there was some misunderstanding as to precisely what the cartel was and what the cartels in Germany were actually doing. As a matter of fact, these were organisations (perhaps the word "pool" would more nearly express their character) of independent manufacturers and, strange as it might seem, of independent consumers. A large proportion of the German cartels were organisations of consumers and not of producers. These had been brought into existence by conditions growing out of the producers' organisations; they therefore found in Germany a peculiar situation, in which organisations of producers were opposing similar organisations of consumers. Some of the German cartels were very loose associations. Some of them merely controlled the conditions of sale; some controlled certain other market conditions; some actually fixed prices; others fixed the proportion of profit or the proportion of the market that was to be allotted to various producers belonging to that cartel.

Only a few of the German cartels had any definite foreign-trade policy, and where such a policy existed it was, in many cases, not well developed. "I think I am justified in saying that Germany has succeeded in foreign trade, not because of her peculiar organisation of industry, not because of the pre-

valence of cartels, but rather because every German manufacturer who goes in for foreign trade brings to that field an energy and perseverance that compel results. He gets all the facts together and then, with his knowledge to guide him, markets his goods in essentially the same way as in Germany."

Dr. Pratt next referred to the work of the Bureau of Foreign and Domestic Commerce in helping American manufacturers in their efforts to win such trade. The nation got information from a number of sources: First, from the Consuls, of whom there were about 400; second, from the commercial agents, of whom there were about 20. These latter were experts on certain commodities, such, for instance, as boots and shoes, or electrical apparatus, or gas appliances. Then, in the third place, they got information from the commercial attachés, a new service which had been in existence about a year. The information obtained from all these sources was brought together, systematised, and co-ordinated in Washington at the Bureau of Foreign and Domestic Commerce, whence it was disseminated by correspondence, through their publications, and by means of their district offices, which were located in eight cities. In addition to these eight district offices, the Bureau had co-operating branches in the chambers of commerce in five other cities.

In regard to the commercial attachés, there were ten of these trade diplomats, with headquarters at London, Paris, The Hague (the man assigned to Berlin is temporarily at The Hague), Petrograd, Peking, Melbourne, Santiago, Lima, Rio de Janeiro, and Buenos Aires. These men did not, in any way, duplicate the work of the consuls. The consuls had a comparatively restricted district and were burdened with a tremendous amount of routine work. The attaché, on the contrary, had jurisdiction over an entire country—sometimes two or three, or even five, countries—and his business was to attend to the more general problems, the things that concerned the country as a whole rather than the minute, local features that concerned only a particular district. For example, their commercial attaché at Rio de Janeiro had given almost his entire time to a careful study of the tariff situation. Their commercial attaché in Petrograd had given a portion of his time, among other activities of promotion and investigation, to getting out embargoed goods. Their commercial attaché at The Hague had given practically his entire time to facilitating the movement of goods, so far as possible, in and out of Holland and Germany. Their commercial attaché at Peking, China, had done a number of things, especially in the way of getting Americans appointed as special advisers to China on such subjects as cotton mills, agriculture, or similar economic matters. Perhaps the most interesting achievement of any of their men was that of their commercial attaché at Paris. "We received an invitation from the King of Spain, coming to us through the Department of State and asking that a commercial man be sent to Madrid. The King desired a conference and exchange of views with respect to commercial relations between Spain and the United States. Our commercial attaché was therefore sent from Paris. In the course of his conversation with the King of Spain, he mentioned to His Majesty the existence of a transport tax on coal—a tax that placed American coal at a serious disadvantage as compared with English coal and, in fact, practically kept our coal out of the Spanish market. His Majesty was much interested and asked many questions. Three weeks later the transport tax on coal was abolished by Royal Decree, and there is now a market in Spain for approximately 3,000,000 tons of American coal a year."

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The I.E.E. and a Current Commercial Problem.

It is always very gratifying when the Institution take under their ægis a commercial problem. Their latest essay in this direction had been taken on the recent issue of the Board of Trade circular asking gas and electric light companies to get their consumers to reduce lighting consumptions by 10 per cent. Thereupon, the Institution duly convened a meeting of the engineers of the supply undertakings. We are sorry, however, to have to criticise their method, even at this preliminary stage. The whole question is a commercial one, and, surely, the commercial side should have been adequately represented. Instead of this, it appears to have been composed of the station and other engineers, despite the fact that the Board of Trade letter does not raise any engineering point but one of policy. History in the past has shown that for such questions to be dealt with by station engineers is to invite trouble. It has not yet been made public what corporate action has been decided upon, but one may be pretty certain that the engineers have been "drawn." We must remember that they are up against very strategic opponents.

I should, incidentally, like to know whether those who are responsible for calling this meeting have taken the trouble to ascertain whether the Department of the Board of Trade who are directly responsible for electric supply undertakings (and the proper performance by them of their statutory obligations) had been consulted on this letter, and whether such department had given their support. Or, as the alternative, whether the letter in question emanated from some one or other department in the Board of Trade whose interests are entirely alien to the electric supply section, and who, acting independently, are trying thus adroitly to "draw" the industry. It is to be hoped that the engineers had not allowed their innocency to be traded on.

The letter from the Board of Trade may be regarded as a kind of knot in the stretched rope of tug-of-war. On the one side there are the electric supply and gas companies, and on the further side there is, one may surmise, a very astute body of colliery owners and others who have everything to gain by decreasing home consumption (which is under "limited" prices) and increasing the export consumption (which can command fancy prices).

With regard to the Board of Trade circular itself, this has already met with full criticism in the electrical and gas Press. One can only regret that on one of the few occasions when the Board of Trade has woke up from its Rip Van Winkle somnolence its activity should not have been better considered. Anyhow, we await with interest the result of the Institution meeting.

Policy.

Justice to Inventors.

I would like to endorse the very opportune letter written by "Fair Play" and inserted in your issue of May 5th. Unfortunately, inventors cannot hope for any immediate assistance from our Government. The immediate question arising, therefore, is: "What is the best course to adopt at the moment?" I would suggest three initial steps:—

1. That every inventor whose British patents are adversely affected by the war should, either directly or through the medium of his patent agent, pay his patent renewal fees under vigorous protest.
2. That inventors should bring their grievance to the notice of their respective trade associations.
3. That trade associations should be invited to co-operate on the subject, and when a fitting time arises they should present a concrete proposal to the Government.

For my part, I have already adopted suggestions (1) and (2), and shall be glad to further joint action and to interest my trade association if the suggestion meets with general approval. In the meantime, inventors are indebted to you, Sir, for allowing this subject to be ventilated in your valued columns.

Inventor.

The Pronunciation of "Ljungström."

I think it would interest a few of us readers of the REVIEW if we had the English pronunciation of the word "Ljungström" as applied to the turbo of that make.

James A. Burns.

Magheramorne, *May 13th*, 1916

[We sincerely sympathise with our correspondent, and have made inquiries; it is difficult to convey the result to our readers in print, but we understand that a fair approximation to the Swedish pronunciation is given by "Yoongstrerm." The *English* pronunciation seems to be a matter of personal taste.—EDS. ELEC. REV.]

The I.E.E. Election.

May I be allowed to say that my sentiments on the matter are identical with those of your correspondent of last week, though I am afraid the course he adopted with his ballot paper may have invalidated it.

Think of a number of years, say, 20. Then can anyone deny that in that long period there would be many more than 20 fresh men to select from; men who deserved and who could act up to the highest position in the Institution?

The Council and the Local Sections seem chiefly to blame in not giving us a new President.

Speaking of Local Sections reminds me that I was once a disgusted member of that at Manchester. It had far less "go" in it than the committee of any sort of club.

There were other things in the ballot paper that were not clear to me, but it showed in black and white that there was only one small body in the whole Institution that had the gumption to put forward an outside candidate for the Council. I voted for him without hesitation.

We have recently been told, officially and numerically, how poor the response is when members are asked to indicate their wishes on voting papers sent them through the post. The conclusion one arrives at from this and other signs is that the majority of I.E.E. members are hopelessly indifferent to things. What else can be said of men who lack the *esprit de corps* to lift a pen, do a little thinking, write a word or two, and spend a halfpenny or a penny on a stamp?

The occasional grumblers (and I am one of them) seem to forget that by co-operation and procedure on regular lines, the carrying out of any desired "reform," if it really had much to recommend it, would be comparatively easy. So perhaps, after all, the Council is not so very much to blame.

W. Perren Maycock.

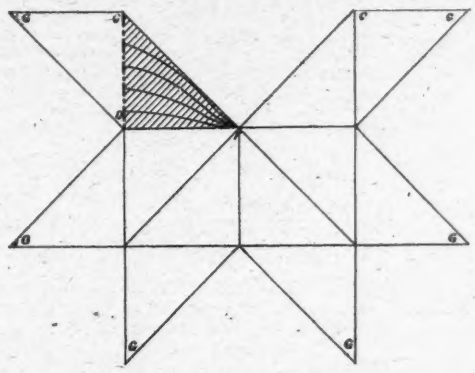
London, S.E., *May 14th*, 1916.

The Resistance of a Cube.

There is an error in the demonstration by Mr. Makower, "The Resistance of a Cube," which is not brought out in the communications of Mr. Carter and Mr. Smith in the issue of March 24th.

Mr. Makower is correct in stating that the conduction in the sides of the cube will be made up of six parallel circuits, each consisting of two triangles in series; but he errs in assuming that the stream lines in these triangles will be the same as when these triangles represent quarters of a square with electrodes at two opposite corners.

This may readily be shown by developing the surface of the cube out into a plane, as in the accompanying figure. F represents one electrode and G the other. F C D is one of the triangles referred to, and the stream lines shown are for the



case when it is part of a square. G C D is the triangle in series with it, and it will be noticed that this triangle is reversed with respect to the first. The result is that the line C D is no longer one of equipotential, and the stream lines will not follow the same course as in the case of the square. Hence the resistance cannot be computed on the basis of this analogy. The result is approximately correct, but is not exact.

Of course, it is necessary to consider an electrode with appreciable size, but this may be taken the same for both square and cube.

M. G. Lloyd.

Chicago, U.S.A., *April 21st*, 1916.

Daylight Saving.

In your first editorial on this subject you referred to having received protests from Mr. Willett and myself against your antagonistic attitude to this measure, and with regard to mine, you expressed astonishment "that one whose profession it is to propagate accurate time service should lend his aid to the destruction of that ideal." I trust, therefore, that you will permit me to reply to the more important points in your two articles.

Greenwich mean time fixes the minutes and seconds only. They remain permanent and universal. I yield to none in my pride in the fountain head of the world's time-keeping, and it was left to me to protest against our lamentable failure to take any share in the work of organising international wireless time service, an undertaking which our country was most competent to perform. Daylight saving takes nothing from the prestige, utility, or permanence of Greenwich mean time, which is the world-wide standard for minutes and seconds. But the position of the hour-hands is variable, is, in fact, already different for each of the 24-hour zones, is fixed by every country for the convenience of its inhabitants, and may be moved backwards or forwards at will to secure the greatest good for the greatest number. A forward movement in the spring is demanded in latitudes like ours, where the inertia of winter habits results in our sleeping many hours behind blinds drawn to keep out the sunlight.

In your current issue you say that the original proposal was optional, and the present one compulsory. There was no more option in the Daylight Saving Bill of 1911 than in to-day's Summer Time Bill. In both the option is with the individual, who may, if he likes, refuse to conform. It is obvious that few would be so eccentric or stubborn as to exercise this option to their own detriment and vast inconvenience.

Why should we feel this to be "a voluntary self-deception and a slur upon our moral strength" any more than the daily clock alteration on an Atlantic liner? The cause is similar, and the object desired is identical. Owing to a change in the hours of daylight relatively to the human time-table, we get out of phase with the sun, and a correction must be made. The one is measured by latitude, due to a change of seasons, and the other is measured by longitude, due to a change in our position.

Denounce, if you like, a calendar based upon hours of uniform length, but unless and until you are prepared to revert to the Roman method of "temporary" hours, *i.e.*, hours of varying length (and, incidentally, to give up the measurement of time, yea, even astronomy itself as an exact science) your only alternative is to pass a Summer Time Bill. I cannot conceive of any other means whereby man can adopt the estimable habits of the lower creation and vary his time-table from winter to summer *with the unanimity demanded by modern civilisation*. If you have an alternative we look to you to suggest it rather than to indulge in purely destructive criticism, which, fortunately, cannot now destroy.

It will be no easy task for my diminished staff to alter 5,000 clocks in London alone next Saturday night, but I think it is to the credit of the electrical profession that it has contributed a method by which it can be done comparatively simply and with precision.

F. Hope-Jones, M.I.E.E.

London, E.C., *May 15th*, 1916.

TRADE STATISTICS OF ITALY.

THE following statement, showing the imports of electrical and similar goods into Italy during the year 1914, is extracted from the recently-issued trade statistics. The figures for 1913 are added for purposes of comparison, and notes of any increases or decreases are given.

	1913. Lire.	1914. Lire.	Inc. or dec. Lire.
Boilers.—			
From France	23,000	17,000	– 6,000
,, Germany	231,000	195,000	– 36,000
,, Great Britain ...	1,077,000	1,142,000	+ 65,000
,, Switzerland ...	146,000	2,000	– 144,000
,, Other countries ...	41,000	16,000	– 25,000
Total	1,518,000	1,372,000	– 146,000
Copper, brass, or bronze wire more than ½ mm. diameter.—			
From France	908,000	941,000	+ 33,000
,, Germany	1,003,000	1,055,000	+ 52,000
,, Great Britain ...	7,000	9,000	+ 2,000
,, United States ...	—	184,000	+ 184,000
,, Other countries ...	49,000	18,000	– 31,000
Total	1,967,000	2,207,000	+ 240,000
Copper, brass, or bronze wire of ½ mm. diameter or less.—			
From Germany	353,000	219,000	– 134,000
,, France	89,000	36,000	– 53,000
,, Other countries ...	45,000*	1,000	– 44,000
Total	487,000	256,000	– 231,000
* Great Britain, 43,000.			
Electrical apparatus.—			
From Germany	3,978,000	3,251,000	– 727,000
,, Great Britain ...	145,000	162,000	+ 17,000
,, Switzerland ...	330,000	308,000	– 22,000
,, United States ...	369,000	397,000	+ 28,000
,, Other countries ...	165,000	105,000	– 60,000
Total	4,987,000	4,223,000	– 764,000
Steam engines, stationary, without boilers.—			
From Belgium	137,000	1,000	– 136,000
,, Germany	646,000	287,000	– 359,000
,, Great Britain ...	802,000	512,000	– 290,000
,, Switzerland ...	4,000	18,000	+ 14,000
,, United States ...	86,000	116,000	+ 30,000
,, Sweden	3,000	—	– 3,000
,, Other countries ...	77,000	31,000	– 46,000
Total	1,755,000	965,000	– 790,000
Steam engines, semi-stationary (with boilers), hot-air motors, compressed air, gas, petrol, &c.—			
From France	150,000	80,000	– 70,000
,, Germany	1,401,000	2,023,000	+ 622,000
,, Great Britain ...	1,779,000	951,000	– 828,000
,, Switzerland ...	329,000	191,000	– 138,000
,, United States ...	150,000	240,000	+ 90,000
,, Other countries ...	165,000	422,000	+ 257,000
Total	3,974,000	3,907,000	– 67,000
Dynamo-electric machines weighing more than 1,000 kg.—			
From Austria-Hungary ...	398,000	166,000	– 232,000
,, France	177,000	99,000	– 78,000
,, Germany	2,937,000	5,564,000	+ 2,627,000
,, Great Britain ...	428,000	172,000	– 256,000
,, Switzerland ...	178,000	489,000	+ 311,000
,, United States ...	56,000	68,000	+ 12,000
,, Belgium	24,000	104,000	+ 80,000
,, Other countries ...	94,000	53,000	– 41,000
Total	4,292,000	6,715,000	+ 2,423,000

	1913. Lire.	1914. Lire.	Inc. or dec. Lire.
Arc lamps.—			
From Germany	220,000	101,000 –	119,000
,, Austria-Hungary ...	5,000	2,000 –	3,000
,, Great Britain ...	2,000	4,000 +	2,000
,, France	19,000	9,000 –	10,000
,, United States ...	1,000	4,000 +	3,000
,, Other countries ...	2,000	— –	2,000
Total	249,000	120,000 –	129,000
Dynamo-electric machines weighing 1,000 kg. or less.—			
From Austria-Hungary ...	636,000	225,000 –	411,000
,, France	132,000	97,000 –	35,000
,, Germany	2,689,000	2,093,000 –	596,000
,, Great Britain ...	322,000	336,000 +	14,000
,, Switzerland ...	161,000	251,000 +	90,000
,, United States ...	131,000	322,000 +	191,000
,, Other countries ...	28,000	43,000 +	16,000
Total	4,099,000	3,367,000 –	732,000
Electric transformers.—			
From Austria-Hungary ...	911,000	1,638,000 +	727,000
,, France	36,000	46,000 +	10,000
,, Germany	1,816,000	2,439,000 +	623,000
,, Great Britain ...	33,000	38,000 +	5,000
,, Switzerland ...	279,000	416,000 +	137,000
,, United States ...	180,000	340,000 +	160,000
,, Other countries ...	1,000	1,000	—
Total	3,256,000	4,918,000 +	1,662,000
Parts of dynamo-electric machines and of transformers.—			
From France	168,000	111,000 –	57,000
,, Germany	975,000	580,000 –	395,000
,, Great Britain ...	194,000	183,000 –	11,000
,, United States ...	60,000	120,000 +	60,000
,, Switzerland ...	49,000	112,000 +	63,000
,, Other countries ...	407,000	55,000 –	352,000
Total	1,853,000	1,161,000 –	692,000
Electric lamps, incandescent.—			
From Austria-Hungary ...	2,362,000	2,672,000 +	310,000
,, France	138,000	131,000 –	7,000
,, Germany	5,486,000	3,863,000 –	1,623,000
,, Great Britain ...	8,000	57,000 +	49,000
,, Switzerland ...	141,000	159,000 +	18,000
,, Netherlands ...	921,000	465,000 –	456,000
,, Other countries ...	36,000	58,000 +	22,000
Total	9,092,000	7,405,000 –	1,687,000
Carbons of all kinds for electro-technical purposes.—			
From Austria-Hungary ...	133,000	121,000 –	12,000
,, Germany	666,000	1,290,000 +	624,000
,, France	86,000	155,000 +	69,000
,, Switzerland ...	41,000	9,000 –	32,000
,, United States ...	50,000	43,000 –	7,000
,, Other countries ...	4,000	2,000 –	2,000
Total	980,000	1,620,000 +	640,000
Accumulators and metal parts.—			
From Germany	33,000	32,000 –	1,000
,, Great Britain ...	10,000	13,000 +	3,000
,, France	80,000	8,000 –	72,000
,, Other countries ...	8,000	28,000* +	20,000
Total	131,000	81,000 –	50,000

* United States, 28,000 lire.

The classes of electrical and allied goods, in which Italy is making most progress as an exporter, are shown in the following comparative figures of her exports (special trade) in 1913 and 1914:—

Dynamo-electric machines weighing 1,000 k.g. or less:—			
To Argentine Republic ...	730,000	664,000 –	66,000
,, France	332,000	207,000 –	125,000
,, Brazil	201,000	22,000 –	179,000
,, Austria-Hungary ...	69,000	48,000 –	21,000
,, Other countries ...	714,000	614,000 –	100,000
Total	2,046,000	1,555,000 –	491,000
Copper, brass or bronze wire more than ½ mm. diameter.—			
To India and Ceylon ...	426,000	213,000 –	213,000
,, Tripoli	79,000	54,000 –	25,000
,, Egypt	16,000	5,000 –	11,000
,, Other countries ...	40,000	68,000 +	28,000
Total	561,000	340,000 –	221,000
Steam engines, stationary, without boilers.—			
To Argentine Republic ...	124,000	136,000 +	12,000
,, Spain	109,000	— –	109,000
,, Tunis	5,000	80,000 +	75,000
,, Russia	41,000	— –	41,000
,, Turkey	50,000	112,000 +	62,000
,, Other countries ...	213,000	119,000 –	94,000
Total	542,000	507,000 –	35,000

	1913. Lire.	1914. Lire.	Inc. or dec. Lire.
Boilers (including multitubular).—			
To Argentine Republic ...	163,000	192,000 +	29,000
,, Tunis	13,000	16,000 +	3,000
,, Tripoli	28,000	11,000 –	17,000
,, Brazil	40,000	21,000 +	19,000
,, Chile	14,000	— –	14,000
,, Egypt	163,000	177,000 +	14,000
,, Other countries ...	24,000	93,000 +	69,000
Total	445,000	510,000 +	65,000
Steam engines, semi-stationary, with boilers.—			
To Argentine Republic ...	990,000	2,650,000 +	1,660,000
,, Tripoli	312,000	85,000 –	227,000
,, Roumania	167,000	126,000 –	41,000
,, Egypt	792,000	352,000 –	440,000
,, France	59,000	5,000 –	54,000
,, Russia	594,000	63,000 –	531,000
,, Great Britain	328,000	18,000 –	310,000
,, Spain	349,000	163,000 –	186,000
,, Turkey	234,000	3,000 –	231,000
,, Other countries ...	933,000	590,000 –	343,000
Total	4,758,000	4,055,000 –	703,000

N.B.—25 lire = £1.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

6,181. "Arc-lamp reflectors." H. Levy & H. Street. May 1st.
6,184. "Methods of attaching telephone receivers to the head." F. G. Baily. May 1st.
6,185. "Apparatus for detecting vibrations." F. G. Baily. May 1st.
6,196. "Electric generating systems." J. H. C. Boyd. May 1st.
6,234. "Electric firing circuits for guns, mines, torpedoes, &c." J. Southern. May 2nd.
6,238. "Miners' electric safety lamps." T. Thomas. May 2nd.
6,241. "Electric hand lamps." S. Fildes. May 2nd.
6,242. "Electric hand lamps." S. Fildes. May 2nd.
6,244. "Plug for telephone switchboards, &c." P. P. Craven. May 2nd.
6,249. "Reversing controller for petrol-electric cars, &c." W. A. Stevens. May 2nd.
6,255. "Transformers." W. H. Wilson. May 2nd.
6,256. "Aerial conductors for wireless signalling, &c." J. Hettinger. May 2nd.
6,257. "Adapting socket for attaching electric shades and lamps combined to lampholders." T. Cracknell. May 2nd.
6,258. "Combined electric switches and plug couplings." J. B. McIndoe. May 2nd.
6,260. "Troughing or trays for electric conductors, conduits, pipes, &c." J. H. Collie. May 2nd.
6,269. "Electrical selectors or impulse responders." L. C. Bygrave and Relay Automatic Telephone Co. May 2nd.
6,274. "Electric batteries." G. F. A. Stone. May 2nd.
6,275. "Electric batteries." G. F. A. Stone. May 2nd.
6,388. "Method of making and maintaining electrical communication in the field." T. H. Clarkson-Jones. May 2nd.
6,292. "Systems of control." British Westinghouse Electric & Manufacturing Co. May 2nd. (U.S.A., May 4th, 1915.)
6,302. "Electric flashlight batteries." J. W. Mander. May 3rd.
6,315. "Sparking plugs and manufacture of the same." H. W. Clarke and T. Crossee & Sons. May 3rd.
6,326. "Electrical measuring apparatus for indicating depth of liquids in tanks, &c." G. B. Burrows & J. Plummer. May 3rd.
6,328. "Automatic telephone systems." W. A. Burrell. May 3rd.
6,329. "Telegraphic transmission devices." R. d'Antonio. May 3rd.
6,339. "Automatic switches or cut-outs for use in charging batteries from dynamos, &c." A. A. Price. May 3rd.
6,355. "Telegraphic transmitters and relays." A. Orling & Orling's Telegraph Instruments Syndicate. May 3rd.
6,378. "Timer or interruptor for magneto." C. Messerschmidt. May 4th. (U.S.A., October 12th, 1915.)
6,379. "Magneto." C. Messerschmidt. May 4th. (U.S.A., June 29th, 1915.)
6,393. "Automatic chain-grate, &c., stokers." London Electric Supply Corporation. May 4th.
6,404. "Electrical regulators." C. F. Kettering. May 4th. (U.S.A., July 26th, 1915.)
6,405. "Systems of electrical generation." C. F. Kettering & W. A. Chryst. May 4th. (U.S.A., October 27th, 1915.)
6,406. "Ignition systems." C. F. Kettering. May 4th. (U.S.A., August 30th, 1915.)
6,407. "Engine starting systems." C. F. Kettering & W. A. Chryst. May 4th. (U.S.A., October 11th, 1915.)
6,467. "Dynamo-electric machines." J. W. Howard. May 5th.
6,476. "Vibrating make-and-break devices or electric signalling." A. C. Brown. May 5th.
6,483. "X-ray apparatus." C. E. Campbell. May 5th. (U.S.A., August 7th, 1915.)
6,491. "Telephone systems." W. H. Grinstead & E. A. Laidlaw. May 5th.
6,516. "Production of sine-wave and like smoothly varying electromotive forces." C. E. Hay. May 5th.
6,517. "Systems of telegraphy." C. E. Hay. May 5th.
6,530. "Electrically-propelled vehicles." C. J. Spencer. May 6th.
6,541. "Electro-magnetic relays." Siemens & Halske Akt. Ges. May 6th. (Germany, June 22nd, 1915.)
6,551. "Electric lampholders." C. G. M. Bennett. May 6th.

PUBLISHED SPECIFICATIONS.

1915.

4,263. Air-cooled Tanks for Electrical Apparatus. Babcock & Wilcox, Ltd. (Babcock & Wilcox Co.). March 18th.
5,630. Mounting of Electric Oscillators for Submarine Sound Signalling. W. J. Mellersh-Jackson (Submarine Signal Co.). April 14th.
5,723. Magneto-electric Machines. P. A. Bentley. April 16th.